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MAXIMUM PC

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MAXIMUM PC

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4 Essential Tech Tips for 2011

We journalists all engage in the same ritual every December. We think past the holidays, and realize that, holy crap, CES is coming. We groan about the lines, the crowds, the people, and the work. All are valid complaints. Coming out of Las Vegas' McCarran Airport this January, for example, I found myself stuck in a taxi line around 700 people deep. And I found myself in this kind of line every single day for three straight days.

What we forget when we're bitching about the overwhelming humanity of CES, however, is how exciting it feels to walk through three humongous exhibition halls showcasing the new technologies and products that will define our technological lives for the next 12 to 18 months.

During and after the show, we all talk about specific products that impressed or disappointed us. I hope you saw some of this in our online coverage—the *Maximum PC* editors were in a literal frenzy canvassing the show floor for products and news. We'll talk about specific CES products in Quick Start and on page 14, but here I'd like to share some guidance about the technologies you're probably thinking about moving into this year.

THE NERD-IN-CHIEF'S PICKS

Top 10 Products of CES 2011
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1. WAIT FOR YOUR TABLETS. In due time, we'll all have multiple tablets in our households, but my guidance is to wait a few more months, and possibly even half a year, before you make the plunge. Of the scores (if not hundreds) of tablet devices shown at this year's CES, the most serious contenders were slated to run Android 3.0, which is being designed specifically for the tablet form factor. Believe me, it's worth waiting for. You might even want to wait a little longer (think mid-spring) for the Windows 7 tablets that are coming. Just don't buy one before our editors pass judgment on whether Windows 7 can offer a speedy-enough tablet experience.

2. DON'T WAIT FOR SANDY BRIDGE. Every PC maker and their moms were showing off Sandy Bridge systems. Intel's CPU is officially great, so there's no reason to wait to buy or build a system based on these processors. By all accounts, the Core i7-2600K is particularly overclockable, if a bit pricey. Numerous developers told us that pushing it to 4.8GHz is easy money.

3. STRONG CONSIDERATION FOR PROJECTORS. My friends are constantly razzing me for my infatuation with projectors, but the truth is that they're getting smaller, better, and more affordable every quarter. Epson will be selling an awesome 1080p projector with two HDMI inputs for $1,200 right around the time you read this. Nothing spells movie night (or game night) like a 100-inch projected image.

4. BUY THAT NEW SMARTPHONE TODAY. Google and Microsoft have started aggressively battling for market share, and the iPhone is coming to Verizon. The net result is bargain prices—$600 phones are being sold for $99. Or less. Whatever your preference, there's no need to wait anymore. By the way, the next phone upgrade cycle—due in about 12 months or so—will see the smartphone officially begin to supplant desktop and laptop computers.

George Jones

LETTERS POLICY Please send comments and questions to george@maximumpc.com. Include your full name, city of residence, and phone number with your correspondence. Unfortunately, George is unable to respond personally to all queries.

THE NEWS

Windows 8 Will Run on ARM, Too

Is there room in the PC for another architecture? —GORDON MAH UNG

It's the end of Wintel as we know it. At least, you might think that, following Microsoft's bombshell that the next version of Windows will run not just on x86, but also on select ARM chips.

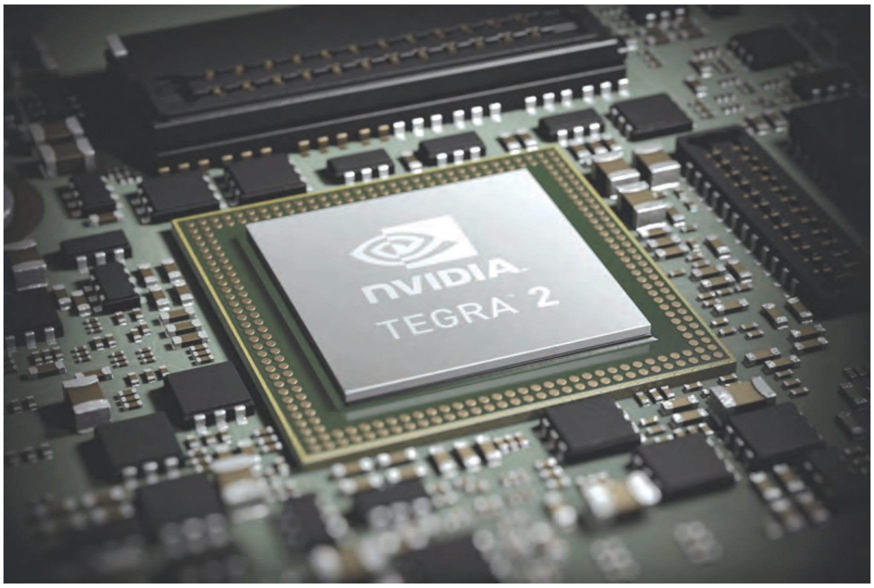
The move had been rumored in the days leading up to the 2011 Consumer Electronics Show, but Microsoft CEO Steve Ballmer made it official in his keynote, saying that the next version of Windows would run on select ARM hardware from Texas Instruments, Qualcomm, and Nvidia. To prove it, Microsoft officials demonstrated pre-alpha Windows ARM running on TI's OMAP, Qualcomm's SnapDragon, and Nvidia's Tegra 2—with the latter even running 3D acceleration.

Ballmer said Microsoft isn't turning its back on x86, but it wants to have the ability to provide Windows for devices of all sizes and it needs ARM for that. "Whatever device you use, now or in the future, Windows will be there," Ballmer said. Details about the ARM version of Windows were few and far between. And issues like which APIs would be supported and what legacy support would be jettisoned were not addressed. Ballmer's announcement did highlight numerous x86 PCs and also included a demo of the next-gen Windows on x86, but it's clear ARM will be a player.

But is this truly the end of Wintel and x86 domination? Nvidia CEO Jen-Hsun Huang doesn't think so. Asked flat-out if he thought it was the end of Wintel, Huang told *Maximum PC*: "No. Of course not." Huang added that "Intel is a mighty company."

That doesn't mean Huang thinks it will last forever, though. During a press conference detailing a $1.5 billion settlement that Intel will pay Nvidia to cover cross-licensing, Huang said that ARM is clearly the way of the future, which is why Nvidia has invested heavily in it.

"With Microsoft's important announcement of ARM support with the next Windows, I think it's a foregone conclusion that ARM is likely to be the most important CPU processor of the future," Huang said. "Mobile computing will be the next computing revolution and ARM is going to be the standard microprocessor of the future. ARM plus CUDA processors can reach from mobile to PCs to supercomputers."



Microsoft demoed a future version of Windows running on Nvidia's new Tegra 2 smartphone chip at CES 2011.

Rob Enderle with the Enderle Group said he expects early Windows ARM machines to work well in automotive, hospitality, and healthcare applications. "I think it will mostly be mobile, but I do expect some desktop penetration in very thin all-in-ones, embedded PCs, and PCs focused on markets heavily concerned with energy use—home energy management, security, entertainment," Enderle said. "On the other hand, x86 has a massive lead in software/hardware compatibility that will need to be closed and the web can't do all of that. In short, this will be an interesting two to three years." But did Enderle think this was the end of Wintel? "Let's just say they are exploring an open marriage."

Over in x86 land, both AMD and Intel predicted that their chips would easily dominate ARM by the time Windows on ARM was out.

"Only AMD Fusion Accelerated Processing Units deliver powerful x86 CPU and GPU-compute capabilities in a single-die processor—a state-of-the-art example of a Windows 7–compliant SoC— for today's HD video, 3D, and data-intensive workloads," an AMD spokesman said. While AMD steered clear of offending Microsoft, an Intel spokesman had no problem firing a shot across the bow.

"Intel looks forward to Windows 8. By the time that OS starts to ramp in a couple of years, we will have the lowest-power, highest-performance chips in the market," he told *Maximum PC*. "That said, we're seeing growing interest in our Atom chips today on a variety of other OSes beyond Windows—Google TV, Chrome OS, MeeGo, and several embedded OSes via Wind River come to mind."

Meow. Perhaps the end *is* coming.

LucidLogix's Virtu

One major weakness of Intel's Sandy Bridge platform is the inability to use the integrated core along with a discrete GPU. LucidLogix believes it has a solution with its Virtu product. Virtu would run in software and virtualize any GPU. This would allow you to, for example, play a game using the discrete graphics card in your system and use the graphics core in a Sandy Bridge chip to encode video. The software would be sold by the motherboard vendor with the board. One problem with the LucidLogix solution is Intel's slightly wacky graphics setup. DVI and HDMI ports are only available on the H67 and lower chipsets, which do not support overclocking. P67 boards, which are more likely to be paired with graphics cards, don't have DVI and HDMI ports at all. **—GU**

Intel to Pay Nvidia $1.5 Billion

A long-running legal battle will end with Intel paying Nvidia $1.5 billion to license its graphics property. It all started when Intel sued Nvidia in 2009 to block the company from making chipsets for the Nehalem family of CPUs.

Intel claimed that Nvidia's contract for a bus license did not cover the new Core i7, which no longer used the ancient front-side bus. Nvidia counter-sued and tried to terminate a cross-licensing deal it had with Intel. In the end, Intel blinked and the two will settle the suit and give each other access to intellectual property. Nvidia, however, will still be forbidden from making chipsets for Intel CPUs. But Nvidia doesn't care. The company is one of three ARM vendors that Microsoft will initially support with a version of Windows for ARM CPUs. **—GU**

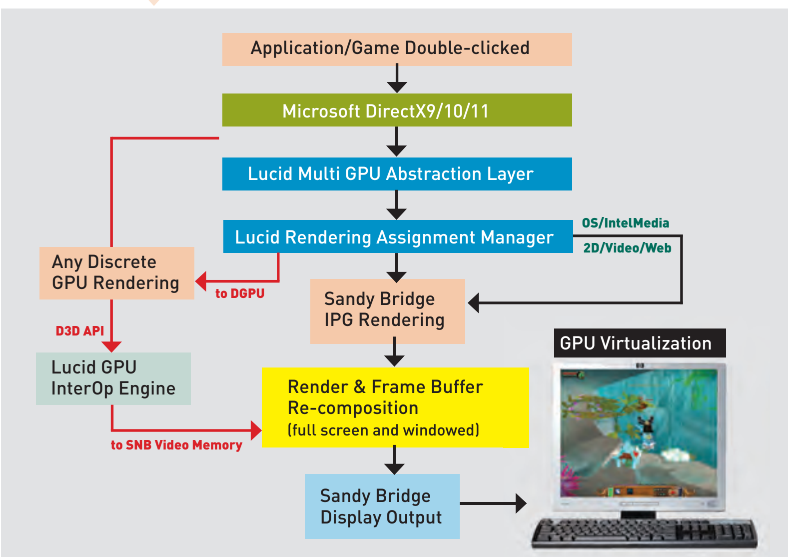


Antec's Kühler H20 620

Liquid-Cooling Shuffle

This year's Consumer Electronics Show brought a flurry of liquid-cooling-related announcements. Corsair announced a partnership with erstwhile competitors CoolIT Systems on a new liquid CPU cooler, the Corsair H60, as well as a software control suite for cooling, lighting, and fans. The software, Corsair Link, bears a strong resemblance to Maestro, the software suite CoolIT demoed at CES 2010.

Antec, meanwhile, took the opportunity to announce two upcoming liquid-cooling products of its own: the Kühler H20 620 and 920. The 620 has a slim radiator and one fan; the 920 boasts a thicker radiator and two fans. Sound familiar? Antec's working with Asetek, the OEM responsible for Corsair's previous liquid-cooling models, the H50 and H70. **—NE**



Virtu works by intercepting the graphics calls and shuffling them to either the Sandy Bridge graphics core or the discrete card.

FAST FORWARD



Merging Microprocs with Memory

Some ideas are crazy enough to work but are ahead of their time. That's my impression of a radically different microprocessor design from Venray Technology, a Texas startup. Maybe someone will acquire Venray's patents and wait until the time is ripe.

Background: Many of today's microprocessors have more memory than logic. Whether measured by die area or transistor counts, the on-chip SRAM caches (L1, L2, L3, etc.) are larger than the logic circuitry devoted to processing.

The reason is that memory hasn't kept up with microprocessors. CPUs waste millions of clock cycles waiting for program instructions and data to arrive from external memory chips that can't respond quickly enough. Caches are a stopgap—the processor fills them with stuff that *might* be needed. When the processor guesses wrong, it must flush and refill the caches, wasting more cycles.

Wasted clock cycles waste energy, which radiates as heat that the system must dissipate at the cost of more energy. In addition, processors must expend power to overcome the electrical resistance and capacitance of the external memory interfaces.

Instead of adding more cache to processors, Venray adds processors to ordinary DRAM chips. The CPU cores hook directly into the memory circuits. The power and cost savings can be enormous, because each DRAM bit cell has only one transistor, versus six or eight transistors in each SRAM cell. Memory bandwidth and latency cease to be problems, because the processors become part of the memory arrays.

However, to snuggle into these dense arrays and take advantage of low-cost memory-fabrication technology, CPU cores must be very small—much smaller than the smallest x86 cores that AMD and Intel currently use. Although programmers can spread software workloads among numerous small cores, parallel programming is hairy, and some tasks have little inherent parallelism.

Another drawback is that some systems may still need external memory. They may also require auxiliary logic and I/O interfaces that aren't easily integrated into DRAM. In the past, similar attempts to combine logic with memory have stumbled for these and other reasons.

Nevertheless, Venray's approach may be the best alternative when other strategies play out. If the patents haven't expired by then, their eventual owner could win big.

Tom Halfhill was formerly a senior editor for Byte *magazine and is now an analyst for* Microprocessor Report.

FCC Releases Net Neutrality Rules

Neither side of the debate is satisfied



Rules governing wired services differ from those governing wireless devices.

The Federal Communications Commission has finally made its stance on net neutrality official. Following a 3–2 vote along party lines, the commission, led by Chairman Julius Genachowski, released new rules governing the practice of broadband providers. The guidelines forbid ISPs from blocking or discriminately slowing down lawful web content of any kind; strongly discourage "paid prioritization" schemes, making them subject to investigation; and require greater transparency regarding ISP management. The commission described the guidelines as "basic rules of the road to preserve the open Internet as a platform for innovation, investment, competition, and free expression."

Not surprisingly, the rules have drawn criticism from both sides of the net neutrality debate. On one side, critics, including the two Republican FCC commissioners, claim that the rules are an example of government over-reach. On the other side, advocates for net neutrality are dismayed that wireless providers are exempt from the rules regarding service blocking and discrimination. So while a wired service provider can't block or slow down the delivery of specific types of content—say, content owned by a competitor or content that uses a lot of bandwidth—a wireless provider is not similarly restricted. The FCC says this exemption is due to technological considerations and that the wireless situation will be monitored.

Then again, whether the FCC has the authority to enforce these rules or any others remains unclear. Last year a federal appeals court ruled that the FCC overstepped its bounds when it intervened in Comcast's traffic-throttling issues. The commission might actually need Congress to grant it oversight powers, which would open a whole new can of bureaucratic worms. **–KS**

MUST-SEE TV

Vizio Integrates OnLive Gaming

Vizio demonstrated new entries in its VIA Plus series of LCD HDTVs at CES that integrate the cloud-based OnLive Gaming System—no console required. The company is also bucking the active-shutter-glasses trend with a line of LED-backlit LCD TVs that utilize circularly polarized filters on the display along with passive 3D glasses. –MB



GAME THEORY



The FCC: Stuck in Neutral

One of the main themes of tech reporting in 2010 was "FCC seeks Internet control." At first, it was kind of amusing that an agency created in the 1930s to regulate the radio spectrum was attempting to exert its nonexistent authority over the entire Internet. The courts quickly told them where to step off, but the Obama administration won't let it rest. If they succeed, it could have a huge impact on PC gaming.

This is no place to hash out the arguments for and against so-called "net neutrality." Simply put: I'm against it. It sounds perfectly reasonable ("protect open access to the Internet!"), but actually addresses a nonexistent problem. Worse, it just lets the camel's nose under the tent. If you think the five appointed political hacks on the Federal Communications Commission are just the people to tame the wild Internet, then your naïveté is kind of sweet. It's also infantile.

Online gamers may well be targeted as "bandwidth hogs" as ISPs try to accommodate growing demands for bandwidth. The rapidly increasing demands for streaming video and online gaming are certainly going to require a better infrastructure. Free enterprise will realize there is a buck to be made, and step in to increase that capacity, or restructure fees so that people who use more pay more.

I'm fine with that. I don't see why my parents' household (which uses the Internet access mostly to forward chain letters) should pay the same fees as mine (which regularly consumes a couple hours of Netflix and a few more of online gaming per day).

In truth, games aren't a vast bandwidth drain. Some estimates put World of Warcraft, for example, at less than 5MB per hour, and a little higher when more characters are involved in a raid. A shooter, however, might eat anywhere from 40MB to 300MB per hour, depending on the game, size of the session, and other factors.

Government regulation cannot increase the bandwidth we need for our games. Only private industry can do that, and the one thing guaranteed to slow that growth is more regulation.

Thomas L. McDonald can be found online at www.stateofplayblog.com.



Kinect Coming to PCs

If you've been feeling deprived over the fact that Microsoft's Kinect motion-controller is exclusive to Xbox 360, cheer up. The camera-based gaming-interface device will eventually come to the PC. That's according to Steve Ballmer himself, who dropped that tidbit during his keynote address at the 2011 Consumer Electronics Show. Of course, the time frame was beyond vague: "We'll support that in a formal way, in the right time," Ballmer said. **–KS**

Home-Control Big at CES 2011

Z-Wave, ZigBee products lead the way

We won't call 2011 "The Year of Home Control," but there were a huge number of new home-control products shown at this year's CES.

Yale showed off a sexy new deadbolt lock that operates on either Z-Wave or ZigBee networks. Unlike similar products from Kwikset and Schlage, Yale's keypad is sealed behind a capacitive touch-screen, making it impervious to dust, water, and other contaminants. Think glass would render the keypad more vulnerable to burglars or vandals? In a video demo, Yale showed the device being subjected to all manner of torture, including a blowtorch, a grinder, a deep freeze, and a hammer—nothing could break the glass.



Yale's deadbolt lock boasts a capacitive touch-screen.

Newcomer Square Connect showed a beautiful Z-Wave-enabled IR blaster and a great home-control app running on an iPad. FortrezZ demonstrated a shut-off valve that closes your home's main water line if it detects a leak. And we can't wait to get our hands on Trane's new ComfortLink II thermostat, which boasts a 7-inch, full-color touch-screen.

Control4 also had a major presence at the show, demonstrating its dealer-installed ZigBee-based residential and commercial automation systems. **–MB**

NO WARRANT, NO PROBLEM

California court permits cell-phone snooping

California's highest court leaned on old U.S. Supreme Court cases to rule that police can confiscate a cell phone from a suspect right after he's arrested and sift through text messages looking for evidence, and do so without first obtaining a warrant.

The ruling came as part of a Fourth Amendment decision involving the 2007 arrest of a Thousand Oaks man who bought ecstasy from a police informant. Text messages on the suspect's cell phone implicated him in the crime.

Jay Leiderman, the criminal lawyer who represented the suspect, described the decision as "weak" and "scary" because it cited older U.S. Supreme Court cases that don't have anything to do with today's technology.

The decision relied on a pair of cases from the early 1970s, one which involved the search of a suspect's clothing and another involving the search of small physical containers, like a crumpled cigarette package. **–PL**

BYTE RIGHTS



QUINN NORTON

The Deprivation of the Public Domain

Every year in much of the world, a year's worth of human creativity becomes public domain. Not in America, though, where we are in the middle of a 20-year drought of creative freedom, on account of copyright term extensions.

The public domain is that bit of human creativity that everyone and no one owns, creative work not covered by intellectual property law. Works by Shakespeare, Verne, and Dickens, all the books of Project Gutenberg, are free to download, and free to use. The public domain is completely free speech that anyone can listen to, yell at, rework, build upon, sell, or share. It's also one of the reasons we have intellectual property in the first place. In America we give people temporary rights over what they create to encourage them to create more, so that in the long run we can have a bigger public domain. It's like an investment: We take less up front, but we get more public domain later. We're meant to get a year's worth of creativity every year.

But starting in 1976, we started choking off the public domain, making the 20th century a slow trickle. Then in 1998, The Sonny Bono Copyright Term Extension, a 20-year extension to all existing copyrights, closed off the public domain altogether. Nothing can flow into the public domain before 2019.

It doesn't punish the clever consumer of media. Our nefarious web browsers can take us to sites in Canada and Australia to download their public domains. It might be breaking a law, but it feels like buying a six pack just over the border of a dry county—technically illegal, but who cares? It really punishes creators, critics, and educators—people with reasons to share and build upon works, exactly the people copyright law was most intended to help.

2011 was meant to be a great year. Kurosowa's classic *Seven Samurai* was scheduled to belong to all of us, as was *Lord of the Flies*. But most ironic? *Waiting for Godot*. We're still waiting, and will be for a long, long time.

Quinn Norton writes about copyright for Wired News and other publications. Her work has ranged from legal journalism to the inner life of pirate organizations.

THE LIST

10 Best Products and Technologies at CES 2011

10 Netgear N600 Premium Edition

Netgear's kick-ass WNDR3700 soundly trounced the competition in our last high-end router round-up, so we were pleased to hear about this sequel. The N600 (also known as the WNDR3800) adds DLNA, remote access to USB storage, and more.



9 ACER ICONIA



Spending some hands-on time with the first dual-screen tablet/laptop left us wanting more. The virtual keyboard (activated by placing both hands on the lower screen) works surprisingly well, and the specs—a Core i5 CPU, 750GB drive, 3G support, USB 3.0, and Windows 7 OS—made us double-take. WANT.

8 Synology DiskStation Manager 3.0

Synology's NAS devices consistently rate among the best in class for performance and features. A new desktop-like user interface refines the product line further by adding drag-and-drop, easy settings apps, and desktop widgets. Available now.



7 LG ThinQ

LG showed off an entire line-up of digitally enhanced appliances—refrigerators, ovens, robot vacuums, and the washer/dryer below. What's the hook? Automatic energy-saving features, built-in error diagnostics, and the ability to control your appliances with Android or iOS devices.





6 Panasonic TC-P65V30 3D HDTV

The fact that this THX-certified plasma TV is a 65-inch follow-up to last year's award-winning 50-inch VT25 is enough to place it on this list. But it's also thinner and features a better 3D experience (if you're into that), and improved LAN/Internet connectivity.



5 PixelOptics Electronic Focusing Eyewear

A layer of liquid crystal is sandwiched in the middle of these bifocal lenses, and can be activated via electronic control to instantaneously change the refractive index of each lens. An accelerometer allows you to switch between reading mode and non-reading mode by tilting your head down.

4 MOTOROLA ATRIX

Have you ever dreamed of showing up to work one day with just your phone and plugging it into your monitor, keyboard, and mouse? The Atrix realizes this dream via two different docks: A standard-looking cradle for desktop displays and a CPU-less laptop chassis with a keyboard, mouse, and battery.





3 1200-Watt Power Supplies

Antec and Cooler Master both showed their new 1200W PSUs running multiple systems simultaneously. Antec's High Current Pro 1200W ran two X58 boards with i7-980X CPUs and dual GTX 580s, while CM's Silent Pro Gold 1200W powered three boards, running i7-975 quad-cores and one GTX 460 each.

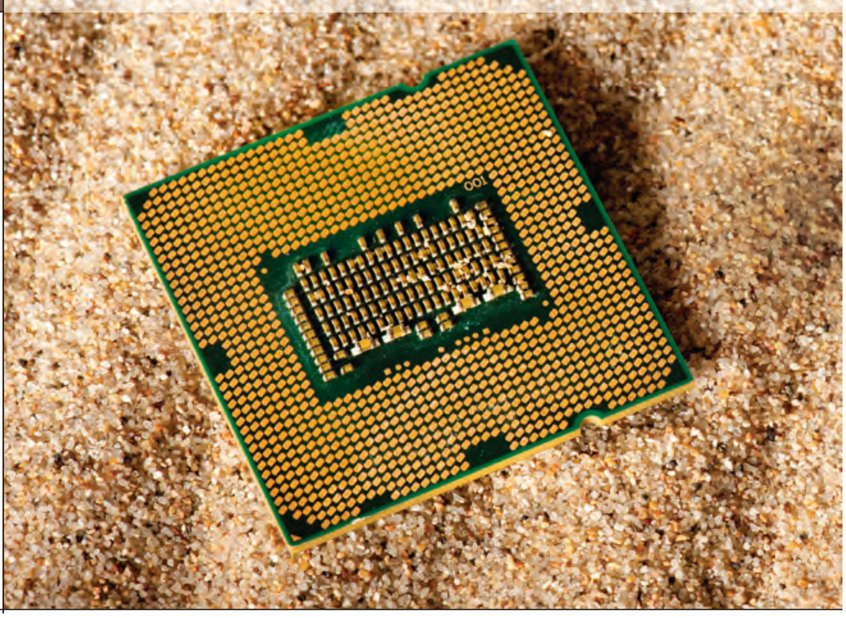
2 Motorola Xoom

This 10.1-inch Android 3.0 tablet impressed us with solid specs—1GHz dual-core Tegra 2 CPU, 32GB of internal storage, a 5MP rear camera, and a 2MP front-facing camera. The presence of Android 3.0 (code-name Honeycomb) means a new 3D desktop, more functional widgets, videochat, and an interface designed specifically for tablet devices.



1 Sandy Bridge

It wasn't even close. For PC makers, Intel's next-gen CPU was the darling of the show. Every PC we saw had one, and we heard endless tales of easy overclocking, stellar performance, and impressive thermals.



DEATHMATCH

Plasma vs. LCD

It's one of the questions we're asked most often. No, not "Will you fix this?" or "What's the matter with Apple products?" This is a much bigger query, one we've hotly debated among ourselves, one that can divide friends and family. That's right: LCD versus plasma. Which is the better display technology? While either will provide you with a picture, we know you want more than that. Having just weighed and debated this very question in order to pick out the best HDTV for the latest issue of *Maximum Tech* (on newsstands now), we figured we'd set the record straight here. **—AMBER BOUMAN**



Plasma
Panasonic Viera TC-P50VT25 50-inch 3D HDTV, $2,600

ROUND 1

LIFE SPAN

While early plasma screens often had a problem with burn-in, plasma manufacturers have found various ways to reduce the problem—using pixel orbiters to move a static image around slightly to reduce burn-in, using gray pillar boxes instead of black, and (in case of charge build-up) image-washing routines that can reset temporarily built-up charges. That's not to say burn-in—and charge build-up, its less-temporary cousin—don't still occur on plasma screens. We saw charge build-up in our testing of Samsung's PN50C8000 plasma screen, but we didn't notice any signs of burn-in in the Panasonic TC-P50VT25. On the other hand, the backlights in LCDs have been known to change a screen's color spectrum over time—ultraviolet emissions from cold-cathode fluorescent lights can cause yellowing in the internal components, while the LEDs in more modern LCDs can age at different rates, causing uneven brightness. Fortunately for (some) LCD owners, the backlight can sometimes be replaced, giving the screen a new lease on life. Plasmas, because they use gases that deteriorate over time, don't have the option of a replacement backlight.

Either way, there's no need for distress as most displays possess a half-life of 60,000 to 120,000 hours. Since eight hours a day would be only 3,000 hours per year, both formats start out with a decent expected shelf life.

WINNER (BY A BACKLIGHT): LCD

ROUND 2
COLOR QUALITY

In our recent side-by-side comparison of a plasma and LCD HDTV, we couldn't help but notice that the colors on the LCD looked oversaturated next to the plasma screen—something that has been reproduced in other side-by-side tests where LCDs were seen to produce warmer, redder shades than plasmas.

In both types of displays, each pixel is comprised of red, green, and blue sub-pixel elements that work in conjunction to create millions of colors. In a plasma screen, each pixel is a little chamber that contains a tiny bit of charged plasma, which emits light that varies in color and intensity based on the voltage applied to the plasma cell, enabling precise brightness control. LCDs, on the other hand, reproduce colors by using polarized filters (in the form of liquid crystals) to block light from the backlight from reaching sub-pixels the screen won't be showing, which is a more challenging way to produce accurate colors, since it works by subtraction rather than addition. **WINNER: PLASMA**

ROUND 3
BLACK LEVEL

It's well known that plasmas beat out LCDs when it comes to producing true, deep black—we've seen the proof during testing time and time again. Picture two flashlights. One is off. The other is on, but has a piece of black construction paper over the lamp. Which one will look darker? Since pixels in a plasma display are powered individually, a black pixel is "off"—it draws no power and emits no light. A "black" pixel on a CCFL LCD, on the other hand, remains "on"—the backlight is on, but the polarizing filter is blocking as much light as it can. Some light still leaks through, creating washed out, grayish blacks.

Newer LED-backlit LCDs can actually turn off portions of the display backlight, as well as automatically reduce backlighting on dark scenes, producing increasingly impressive black levels and contrast, but plasma screens still produce a better, darker black. **WINNER: PLASMA**

ROUND 4
OFF-AXIS VIEWING

LCDs get the short end of the stick here, as they typically have poor off-axis viewing thanks to the polarized filters they contain, which cause black levels, color, and brightness to change when you move away from a front-and-center position. Testing done by Dr. Ray Soneira of DisplayMate (www.displaymate.com) showed noticeable picture degradation at +/- 10 degrees away from center on an LCD screen, while plasma screens performed significantly better, showing virtually no change while being viewed from +/- 45 degrees. **WINNER: PLASMA**

LCD
LG 47LX9500 47-inch 3D HDTV, $4,000



ROUND 5
PRICE

At the middle of the size range, the playing field is nearly level—below 42 inches or so, display prices for LCDs and plasma displays are within a few hundred dollars of each other. At the high end, though, plasmas become a better deal—the bigger the display size, the more likely you are to be able to get a plasma TV for less money than a same-size LED LCD. It's worth noting that life span does play a part here, since some LCDs can get a new lease on life via a backlight replacement, while plasmas cannot, as the gases in them simply deplete and can't be replaced. If you're into getting the biggest bang for your buck and you want to go large, go plasma. At smaller screen sizes, though, LCDs are more competitive. **WINNER: PLASMA**

And the Winner Is...

In our *Maximum Tech* feature, **plasma** TVs wound up the victor, and this Deathmatch proves why. Plasmas offer better blacks, more accurate colors, and a wider viewing angle. At larger sizes, they're also the less expensive option—though potential burn-in and shorter life span are disadvantages. LCDs are definitely still in the race, especially given the trend toward LED backlighting, which removes some of the inherent disadvantages. For now, though, we're all about plasma.

This month the Doctor tackles...

Ass-Kicking BSODs
Fan Control
Recurring Viruses

Rig Transport

I have two regular-size rigs that are about to either get mailed to the States from where I'm stationed in Germany, or get packed up with the rest of my stuff and put on a boat. I've shipped a computer before, but it was only bubble-wrapped on the outside of the case, and was therefore damaged when it arrived at its destination. What's the best way to pack and ship a computer? Should I disassemble it and individually wrap all the components? Can I leave it assembled and fill the inside of the case with packing peanuts? Thanks.

—Jake

The most important thing to do is to remove anything that can put too much stress on your motherboard during transit. At a minimum, this means removing your graphics cards, and any other heavy expansion cards—they can bust your PCI-E slots and ruin not just your GPU but your motherboard. If you have a big CPU cooler (anything larger than stock), consider removing that, too. Basically, you should remove anything that can twist or bend things if its weight is allowed to bounce around, or anything that can come loose during transit. Hard drives are probably fine, especially if the write heads are parked when the power is off, but it doesn't hurt to coddle them. If any of your components are held in with retention clips instead of screws, consider using screws to mount them down for travel, or remove the parts entirely. The last thing you want is something rattling around inside your case.

We wouldn't put packing peanuts inside a case—they can build up a static charge if you're not careful. Bagged air might be better. Alternatively, many system builders use the kind of expanding foam that molds itself to the negative space around your components.

Fwd: Re: Fwd: Re: Re: Check This Out!!!!

I need your help. I have gotten viruses on a computer and I'm having a hard time getting rid of them. I don't have Internet access on that particular computer to download an antivirus program. I have downloaded A-Squared Free and have had limited luck removing viruses permanently. I seem to find viruses that are "zipped up" or embedded in another program that is received by email, and once opened on an unprotected computer the viruses re-emerge.

Microsoft Security Essentials is available but the program will not run without an Internet connection to obtain continuous updates of the definitions. Is there a free antivirus app I can use and a way to obtain updates without a continuous Internet access?

—Becky Williams

Becky, the Doctor is reminded of a joke his grandfather used to tell. Guy walks into a doctor's office and says, "Doc, you gotta help me. It hurts when I do this." The doctor replies, "Well, don't do that!"

If you keep getting a virus from opening email attachments or infected ZIP files, please stop opening those files. You should never open an email attachment unless it's from a trusted source and you're expecting it. Delete those attachments from your computer and stop opening them, and the virus should stop reappearing on your computer.

For virus and malware removal on a PC without Internet access, use a PC that does have Internet access to download a portable version of SuperAntiSpyware (http://bit.ly/a2ncSc) or Avira's LiveCD (http://bit.ly/euGNCu).

Dude, Where's My Drive?

I built a new PC as directed by your "Builder's Creed" story (November 2010), but I have a problem. The SSD has the OS on it and shows up in all the right places. The Seagate shows up in Disk Management but not in My Computer. Disk Management says the Seagate drive is "unallocated" and "system reserved." It shows the correct drivers and says the drive is working properly, so why can't I see it? I followed the directions and didn't plug in the drive until after the OS was installed on the SSD and the computer was powered off. Is the drive not being used?

—Tom Franks

Tom, the drive is plugged in and working correctly, but most drives ship without a primary partition. In Disk Management, right-click the drive (on the space that says "unallocated")and click "New Simple Volume," then follow the prompts to create a partition with the maximum available size. You'll want an NTFS partition type, and select "quick format" unless you want to be there all night. Your new partition should be created in a matter of seconds, and then the drive will appear in My Computer.

Power to the Fans

I am building a new rig and want to run as many fans as possible with the motherboard's headers without smoking anything. The mobo is an Asus P7P55 Pro and I want to run a maximum of three 12cm fans off one header (one header will have three fans, one will have two, and the rest one). My previous rig had some cooling problems and I want to be able to play air-hockey on this one or possibly cause it to hover in place for brief intervals. I have a fan controller that I haven't installed, but I'd like to avoid using it because it's ugly.

—Stan Mitchell

Stan, we've successfully run two fans from the CPU_FAN header with no problem, but running three fans from the same header is pushing it. Running more than one fan off a single header will also confuse the board's ability to monitor and control the fan speeds. Since you don't want to use a fan controller (or at least not the one you already have),



Need to power a whole mess of fans from one plug? This little Sunbeam Tech device, which costs about $13, might be just the ticket.

we'd suggest using 4-pin–to–3-pin Molex fan adapters, or—if you're feeling fancy—Sunbeam Tech sells a little device that'll run six 3-pin fans from one 4-pin Molex plug. You can find it for about $13; it's on NewEgg at http://bit.ly/gLRHTx.

Ass-Kicking BSODs

Under what kind of system error would a PC run perfectly smooth for two to three weeks, then suddenly seem like it's getting ass-kicked in a fighting game by a BSOD combo?

The BSOD issue first occurred when I upgraded my graphics card from a GTX 260 to a GTX 460. Originally, I thought the 460 was at fault, so I replaced it with a Radeon HD 6850 (both cards consume less power than a GTX 260), but the same BSOD issue still repeats itself. I tried to solve the problem by physically cleaning my PC's hardware, resetting virtual memory sizes, updating ESET anti-virus software, testing memory via Windows' built-in diagnostics tool, using Windows Installation Disc to run system repair, and even changing my soundcard's PCI-E slot. None really worked. (Note: The BSOD screens are either "Special Pool Memory Corruption" or "PFN List Corruption.")

My system is a nearly 2-year-old Core 2 Quad 9300 (no overclock) on an ASRock P43DE with 8GB of Crucial DDR2 memory, a Power Color Radeon HD 6850, a Creative SB X-Fi Titanium, and two Western Digital SATA HDDs (a WD10EADS 1TB and a WD5000AAVS 500GB). My power supply is a SilverStone Strider 700W. My OS is Windows 7 64-bit Ultimate (retail) using traditional Chinese UI.

Never in my PC-DIY life have I encountered such a weird BSOD problem.

—Hao Chen

The Doc normally blames the power supply but in your case, you have a reputable PSU that seems to have plenty of wattage for your system's means. Since you've already cleaned your system fans, it's unlikely you're having overheating issues, either. That leaves RAM as the most likely culprit. You noted that you ran Windows 7's memory test, but we also recommend running the free and quite good Memtest+ test (www.memtest.org) on the machine. You may also want to try removing one stick of RAM at a time to see if you can eliminate the issue. Your errors also may be from corruption on the hard drive. If the RAM checks out both in the Memtest+ tests and by pulling sticks, you may want to consider a Windows 7 reinstall, as well. Remember, when you pull RAM or the GPU, make sure that you power down the system by switching the PSU off for at least 30 seconds or by pulling the plug from the wall.

This isn't to say that you don't have a bum power supply, only that it's not necessarily the first thing you should look for. Try the RAM thing first.

SUBMIT YOUR QUESTION Are flames shooting out of the back of your rig? First, grab a fire extinguisher and douse the flames. Once the pyrotechnic display has fizzled, email the doctor at doctor@maximumpc.com for advice on how to solve your technological woes.



ILLUSTRATION BY ADAM BENTON

Powered Up!

79 tips for the most popular applications on the planet

BY SEAMUS BELLAMY, PAUL LILY, AND DAVID MURPHY

Everyone—and we mean *everyone*—has their favorite tips and tricks for their favorite (or at least most commonly used) applications. We're even talking about you, grandma. The tricky part is that if you asked 20 people for their favorite tips for, say, Microsoft Word, you'd get 60 different responses.

So, which ones are the most important? Which tricks are the ones that you can't live without? We have our favorites, for sure, but this month, we decided to try to whittle things down to the most useful and essential. Over the course of the next several pages, you'll find the most powerful, efficient, and downright practical secrets to the most popular applications on the planet.

From Word to Windows Media Player, from iTunes to Dropbox, you'll find a smorgasbord of keyboard shortcuts, performance-enhancing tips, and time-saving tricks. But this is just the beginning. We're going to use this story as a springboard for an even deeper dive into the tips-and-tricks pool on our website. Send us your very best single tip for one of the applications here. We'll choose the top five and give you *Maximum PC* coins and other awesome swag. Send your tips to comments@maximumpc.com and stay tuned for more info.

Google Chrome

Google's most recent browser release is rapidly becoming our all-time favorite because it's so customizable. Here's how to make the most of it

CONFIGURE MULTIPLE HOMEPAGES

Consider yourself a power user, do you? Then why rock but a single homepage? You can configure Chrome to load multiple sites every time you open your browser. Click the Wrench icon and navigate to Tools > Options and start adding sites. Don't overdo it, though—you'll bog down your initial load time.

CHEAT AT MATH

The Google Suggests feature in Chrome is your key to impressing coworkers with your unlimited knowledge of numbers. Just type your math query into the Omnibar and the answer will appear without ever having to punch the Enter key. Goodbye, Windows Calculator!



DIG YOURSELF OUT OF A LINK HOLE

Once you've burrowed deep within a website, navigating back several pages (or to the beginning) involves rapid-firing the backspace key. Hello, carpal tunnel. There's a better way—click and hold Chrome's back button to see a list of links you've been to. This works with the forward button, too.

TEST DRIVE MULTIPLE VERSIONS OF CHROME

If you want access to new features before everyone else, you have to subscribe to Chrome's Beta or Dev channel, both of which replace your stable build. Not keen with that? Try Chrome's Canary build (http://tinyurl.com/2b2jof9). It's the most frequently updated version of Chrome, and it installs alongside whatever other version you're running.

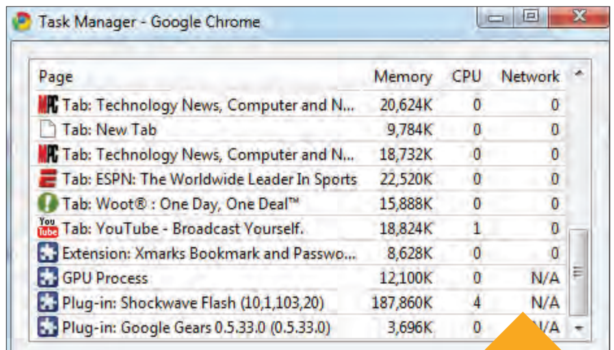
CONVERT WEB PAGES INTO APP SHORTCUTS

App shortcuts open in a dedicated window devoid of browser buttons and are handy for frequently accessed sites like Gmail, Twitter, Facebook, YouTube, and, well, you get the idea. To create one, navigate to Wrench > Tools > Create application shortcuts… and punch the Create button.

LEARN WHAT ALL THE FUSS IS 'ABOUT'

You're probably already familiar with Firefox's About:Config page, and while this doesn't work in Chrome, several other About pages do exist. Try these on for size:

- **About:DNS**
- **About:Cache**
- **About:Plugins**
- **About:Memory**
- **About:Crash**



AUDIT YOUR TABS

Have a sneaky suspicion that one of your tabs is a resource pig? You can find out which sites are dragging down your browser (and your system). Just hit Shift + Esc to open Chrome's built-in Task Manager to see the amount of memory and CPU cycles each tab is consuming.

EDIT ANY SITE'S CODE (LEGALLY)

We don't condone hacking into someone else's website, but you can muck with any web page locally so that the changes are only visible on your PC. Right-click any part of a page you want to alter and select Inspect Element. Any changes you make to the Elements tab will appear in real time.

BENCHMARK YOUR WEBSITE'S LOAD TIME

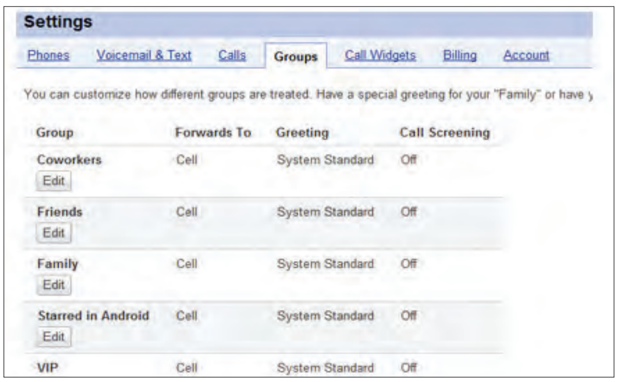
The Inspect Element option is also your gateway to seeing how fast certain parts of your site (or anyone else's site) load. Access the Inspect Element option the same as before, but this time head over to the Resources tab. Use this info to code a super-lean web page.

SHRINK TABS INTO FAVICONS

One of the headaches that comes with being a power surfer is that our browser window quickly gets cluttered with tabs. Luckily for us, Google made it easy to wrangle tabs into manageable favicons that take up much less space. Just right-click and select Pin Tab.

Google Voice

In our minds, Google Voice is rapidly becoming an essential web app for any power user. Why? Because it connects all of our phone numbers together, making our lives easier... and more awesome



Real Google Voice power users use calling groups.

ESTABLISH CALLING GROUPS

This is one of the most helpful resources of all time. Under the Settings window, click forward to the Manage Groups page, which allows you to add an unlimited number of people either to one of the five default groups listed in Google Voice or to a custom group of your own making. In doing so, you can isolate individuals in a bunch of different useful ways. For example, you can specify that anyone in your "Coworkers" group who calls your Google number is automatically routed to your work phone, delivered a specific greeting if they bounce to voicemail, and allowed to dial through to you unscreened.

LOCKDOWN YOUR PHONE

Google Voice can be downright handy in its ability to dial up all the different phones you control whenever anyone calls. But do you really want your apartment or office breaking out in a cacophony of sound every time someone calls? Google's solution is buried in the Phones > Edit > Show Advanced Settings window off of the main settings page. Nestled within this link is a series of options that you can customize for each phone you've added to Google Voice, including scheduling times for when you want Google Voice to forward a call to a specific phone. Or not.

INTEGRATE VOICE INTO YOUR DIGITAL LIFE

There are a number of ways to integrate Google Voice into your daily habits without having to fire up the site itself. Firefox users will want to check out either Google Shortcuts or the aptly named Google Voice Add-On for Firefox if you want to place calls directly via a browser button. Google Chrome users have it a bit easier (go figure), as Google itself has written a Chrome extension to build quick-call access directly into the browser. If neither of these add-ons piques your interest, you can always opt for a lesser approach and integrate Google Voice into your Gmail window.

MASH 'EM UP

Voxox (www.voxox.com) is great because it allows you to manage Google Voice interactions, IM chats, and social-network connections in one central location. When you install the program and sign up for this free service, you get a single phone number, which you want to link to Google Voice. The caveat is that only incoming calls and texts are free—attempting to use the service to make outgoing calls or, worse, send outgoing texts will incur a separate fee.

GET RID OF YOUR LANDLINE, FOREVER!

Gizmodo's Casey Chan recently authored an excellent how-to guide for using a device called the Telo to make and receive free VoIP calls. But instead of doing this across your PC à la Skype, Ooma's $250 Telo bridges a real, physical handset with Google Voice. You can find the how-to at http://gizmo.do/ep0Dot.

TURN GOOGLE VOICE INTO SKYPE

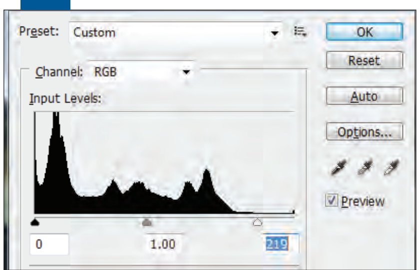
If you want to use an old-fashioned headset and mic to dial up your friends via Google Voice, Sipgate (www.sipgate.com) can help. The free version of the program/service gives you one free phone number (which you'll tie into Google Voice) and an app that lets you access service via a typical headset/mic combination. Here's the trick: Since Sipgate only gives you a certain block of time for free calls, you'll want to dial friends using Google Voice (which, in turn, rings your Sipgate number) and answer common phone calls via Sipgate's app.

SET UP RINGING BY LOCATION, NOT TIME

What if you don't want to block calls to your phone based on the time of day, but your location? This isn't a trick that applies to all mobile devices, as we've only managed to locate instructions for Android-based phones thus far. That said, blogger Chad Smith has written up a pretty extensive guide for setting up Google Voice so that calls are forwarded based on your location. To do so, you'll need an Android phone, the Locale geo-location app (www.twofortyfouram.com), and this Lifehacker how-to: http://lifehac.kr/gvfASt.

Photoshop

Adobe has tucked a lot of power into its photo-editing software application; here's how to tap into it without breaking your brain



MAKE IMAGES POP

One of the simplest ways to add a little razzle-dazzle to darkened images is to lighten an image and then sharpen it. Click on Images > Adjustments > Levels and adjust the sliders until you like the result. When you're finished, bring your image to life by selecting Filter > Sharpen > Sharpen.

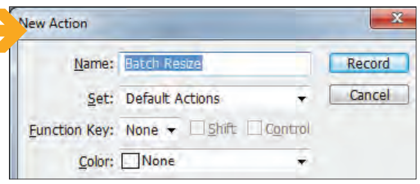
CREATE YOUR OWN MEME

Have an awesome picture and an even wittier caption to share with the world? If you want it to look like most other lolcats, failboats, and Internet memes, create your text using the Impact font and then Stroke an outline (Layer > Layer Style > Stroke).

HIDE THE SELECTION OUTLINE

In some instances, you may want to hide the blinking selection outline while manipulating an image. You can do this by pressing Ctrl + H. Note that the selection is still active, you just can't see it. To bring it back into view, press Ctrl + H again.

BATCH RESIZE PHOTOS



If you plan to upload oodles of high-resolution vacation pictures to Facebook, you should probably downsize them first. Open a photo and then click Windows > Action. Now click the down arrow, select New Action, and name it "Batch Resize." Press the Record button and then proceed to resize your pic, save the image, close it, and press the Stop button. To use your new macro, go to File > Automate > Batch.

CUSTOMIZE THE GRID

Photoshop's Grid feature (View > Show > Grid) is an invaluable tool for aligning objects, but sometimes the Grid blends in with your image. It's easy to change how it looks. Navigate to Edit > Preferences > Guides, Grids, & Slices, and fine-tune to your liking.

STRAIGHTEN AN IMAGE

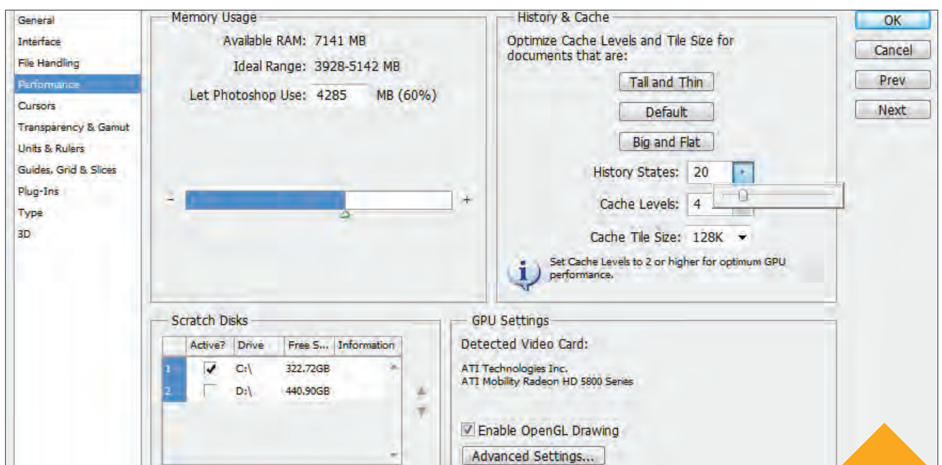
Find a straight surface in your photo—like a tabletop—and use the Ruler tool to create a straight line. Now, go to Image > Image Rotation > Arbitrary and notice that the corrected angle is already filled in. Hit OK and watch as your photo is automagically straightened.

GET HANDS-ON

Hold the spacebar to turn the cursor into a hand icon and use it to drag your image. Release the spacebar to continue working. This comes in ultra-handy when manipulating a large and/or zoomed-in image.

CHANGE BRUSH SIZES ON THE FLY

This single tip has the potential to save you a ton of time. Rather than bring up the brush menu to make it bigger or smaller, use the left and right bracket keys. This also works with the Eraser tool.



IMPROVE PHOTOSHOP'S MEMORY

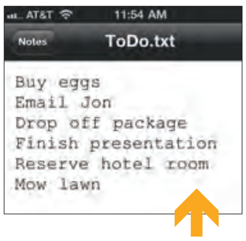
You can undo changes and step back in time by pressing Alt + Ctrl + Z up to 20 times by default. Not enough? Go to Edit > Preferences > Performance and choose any number from 1–1,000. While you're in there, you can adjust how much RAM Photoshop is allowed to use.

Dropbox

Gain free storage space, perform off-site backups, share your account safely, and more!

STAY ON TOP OF TASKS ON THE GO

If you've installed Dropbox's app to your Android or iOS smartphone, it's easy to stay on task when you're mobile. Create a to-do list on your PC and save it to your Dropbox folder. Then, access it on your smartphone while you're out to ensure that you never forget the milk—or anything else—again.



GAIN MORE SPACE

If you want more than the default 2GB of storage without having to pay for it, log into Dropbox's website and click Get Started > Invite Friends. Every person you refer that opens an account will snag you an additional 250 megabytes of space, up to a maximum of 8GB.

BUILD AN ONLINE STORAGE EMPIRE

No friends to refer? No problem! Just set up a few Gmail accounts and open a new Dropbox account for each. Then, silo off what each new account is used for: documents, photos, PDFs, and, well, you get the idea. For an even bigger piece of the cloud, consider turning seven gigabytes of each of those Gmail accounts into usable chunks of cloud storage with Gspace.

DO OFF-SITE FILE BACKUPS

For those of us with spartan data backup requirements, there's no need to invest in expensive hardware-based backup solutions. Just dump your files into your Dropbox folder on a regular basis. When your computer connects to the Internet, Dropbox will save an off-site backup of the files. You can set a routine calendar alert to remind you to update your backups on a regular basis.

HOST BLOG FILES

If you have a blog, you can use Dropbox to host its photos. Just drop your content into Dropbox's Public folder. Once the image you want to work with has synchronized to the cloud, right-click it and select Copy Public Link. Paste the link into your blog's back-end interface. Boom: The photo will appear on your blog.

SYNC ITUNES ACROSS MULTIPLE COMPUTERS

Move your iTunes library and associated library .xml file into your computer's Dropbox folder and tell iTunes where the new library is located. Set your iTunes preferences on another computer to find the library inside of your Dropbox folder. Let the files sync to the second computer from the cloud and you're ready to rock and roll.

SYNC YOUR PASSWORDS

When used in conjunction with programs like KeePass Password Safe (www.keepass.info) or 1Password (www.agilewebsolutions.com), Dropbox will not only help you back up all of your computer's security-passcode information, it will let you sync that info to any other machine with KeePass or 1Password installed. It's multibox security made easy.

RECOVER DELETED FILES

If you delete a file from your Dropbox folder and live to regret it, in most cases, you can recover it with ease. Navigate to Dropbox's website and log in. Click the Show Deleted Files button. Now click the file you want to restore and click—you guessed it—Restore. The file will be returned to your computer's Dropbox folder almost instantly.

STEAM

What's an online gaming service doing here, you ask? Read on to find out

MOVE YOUR GAMES Perhaps one of the most useful Steam add-ons we've found to date, Steam Mover (http://bit.ly/cWNjWN) automatically handles the process of moving your huge Steam titles to other locations (like a secondary hard drive). More importantly, it processes the internal Windows linking that will automatically allow Steam to find your moved games without even the briefest of interruptions.

SAVE YOUR GAME... SAVES If you're moving to a new computer or upgrading parts, don't forget to move the associated saved games. Check out the application SaveGameBackup (http://bit.ly/gfN5Vq), which does a great job of finding the location of these critical files and helping you save them to a new spot.

DEFRAGMENT THY GAMES Have you noticed that your loading times for Steam titles have gotten unwieldy? If so, perhaps your larger titles are in need of a defragmentation! Right-click any installed game in your library, then select Properties. Within this window, you'll want to click the Local Files tab. If your fragmentation level is high, just click the Defragment Cache Files button to clear it back to low levels.

STAY ON TOP OF UPDATES Not only can you update your videocard (ATI users only!) via Steam's "Steam" menu, but you can also dig a little deeper into Steam's preferences and ensure that you're always using the latest, greatest features that Valve has to offer. To do so, periodically check your Steam > Settings window to see if you're eligible for a beta update—select it via the Change button, and you'll be at the forefront of Valve's proposed Steam updates.

PLAY GAMES OFFLINE Let's face it: Steam is a powerful tool, but it's not as if you're always going to be online whenever you want to play one of the games assembled in your directory. The app's offline mode can be a bit tricky, especially for novice users. Here's why: You have to first launch the game in online mode—if you don't, there's no way it's going to work the first time you go offline via the Steam menu within the app. Do that first, however, and you'll be able to play said title without an Internet connection—way useful!

iTunes

Surprise, surprise—Apple's vaunted media player is more flexible than you think

PUNISH PING

For whatever reason, you might not want to jump onboard with Apple's Ping service. That's fine. Apple isn't twisting your arm to sign up for Ping. Now, suppose you want to remove all the Ping options from your right-click context menu, as well. There used to be a fancy little way to do it via a command-prompt window. However, that's since been replaced by an easier method: Click Edit, select Preferences, find the Parental Control tab, and check the box next to Ping.

'SHARE' YOUR LIBRARY

Here's the deal: If you do happen to be in the situation where different computers on your network have different music files on them, it's possible to grab the exact songs you want from any other networked iTunes application using a third-party piece of software. The app's called Aethyr (www.aethyrjb.com), and it's an Adobe Air–based program that lets you rip music, as it were, from any other iTunes you can find on your network. We suppose this would be considered the Holy Grail of applications for one on a college dorm network, but what you're thinking about is illegal and wrong. Shame on you.

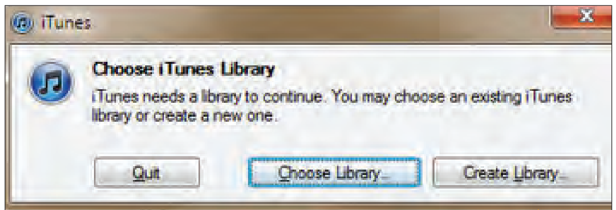
DOUBLE LIBRARY TROUBLE

We won't get into the specifics, but there are many reasons why you might want to build a separate iTunes library. Here's how it works: Just hold the Shift key before you launch iTunes. It's as simple as that. The software will prompt you to either pick a library or create one. If you do the latter, your two libraries will exist completely independently of each other—which can be a pain if you want to, say, add some MP3s to both.

BROWSE WITH FIREFOX AND ROCK WITH ITUNES

Firefox's awesome FoxyTunes add-on allows you to see what's playing, jump tracks, seek out specific parts of a song, and do all the sorts of things you'd expect to find on the iTunes Mini Player… right within your browser. As a super-fun bonus, FoxyTunes even comes with both an alarm clock and a sleep timer—perfect for the times when you want to take a little nap to the sweet sounds of Nine Inch Nails. Or something. Get it at www.foxytunes.com.





SYNC ANDROID TO ITUNES

We love the application Double Twist because it lets us synchronize our Android phones with an iTunes library. Grab the client application at www.doubletwist.com, download the associated Android application on your phone, and you're good to go.

Another alternative is an app called iTunes Sync. So long as you flip your Android phone over to disk-drive mode, you'll be able to pull it up directly within iTunes—but more importantly, you'll be able to use iTunes to manage the playlists that synchronize to your Android phone, as well. Download it at http://bit.ly/erVQQi.

WHO'S LISTENING TO MY ITUNES?

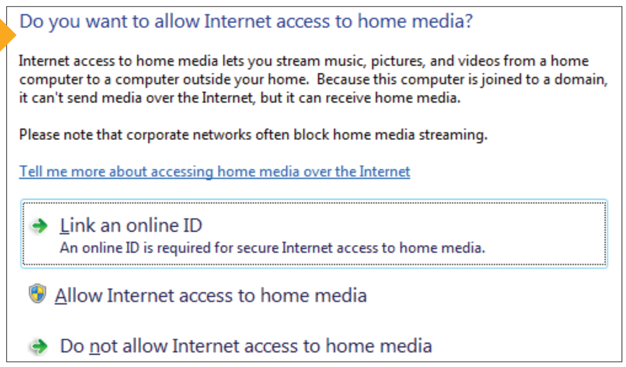
Assuming you've enabled all the various music-sharing mechanisms within iTunes, have you ever actually been curious to find out who's connected to (and rocking out with) your system? Head on over to Microsoft's site and grab the application TCPView (http://bit.ly/fPmsuf). Fire it up and scroll down until you find the iTunes listings. (Yes, the program automatically updates when connections drop on and off.) If you don't recognize the IP address or local address, which means it's not your system's name or "localhost," then you have a fan who's listening to your iTunes as we speak. If you want to pull the person's plug, right-click the corresponding line and select End Connection.

Windows
Media Player

Transform good old WMP into the GMPE (greatest media player ever) with our help!

STREAM MEDIA ACROSS THE WEB

A lesser-known feature of Windows Media Player 12 is its ability to allow you to share your music library with approved systems across the web. Click the Stream button within WMP's Library view and select "Allow Internet Access to Home Media." You'll have to sign up for (and download) a file from Microsoft in order to link your Windows Live ID to your actual desktop system. But once you've done so (on two different computers, that is), your personal radio station, of sorts, will be all set.



Did you know you can create your own Internet radio station with Windows Media Player?

KEEP PLAYLISTS PRIVATE

Nothing is more embarrassing than hopping on a friend's computer and finding that the "most frequently played" or "recent files" listing is full of unsavory videos. To keep WMP from archiving a list of your most frequently played media—whatever that media happens to be—click Tools > Options. Click to the Privacy tab and uncheck all four options at the very bottom of the screen—music, video, pictures, and playlists.

LOCK YOUR PC

Let's face it: Life is short. One doesn't always have time to pause a sound file or otherwise stop one's jam session when more important issues beckon. That's where the third-party app MonitorES (www.code.google.com/p/monitores) comes into the picture. If you have to jet away for a period of time, just lock your PC (with the handy Windows key + L shortcut combination). MonitorES will not only pause your music in Windows Media Player, it will also flip your monitor off and set the status of your instant-messaging clients to whatever you'd like. Easy as pie.

HOTKEY IT UP

It's not that difficult to use Windows Media Player's built-in hotkeys, but it's annoying to have to keep Alt-Tabbing back to the player in order to use those shortcuts—you can't just jam Ctrl + P inside any window to pause or play a particular song in question. WMPKeys fixes this by giving you new, global hotkeys for a few of WMP's more commonly used features. Download it at http://bit.ly/h9zdvR and you'll be able to skip tracks, play music, and even rate songs no matter what window or application you're staring at.

SAY WHAT?

If you're a fan of subtitles within movies, then you are likely not a fan of Windows Media Player 12's less-than-stellar support. Grab the add-on DirectVobSub at http://bit.ly/fLfbnb to open up access to a bevy of popular subtitle formats. So long as the plugin is working and enabled, all you have to do is make sure the corresponding subtitle file follows two rules: It's named exactly the same filename (minus the extension, obviously) as the file of the video you're trying to watch, and it's located in the same folder as said video.

10 ESSENTIAL WMP KEYBOARD SHORTCUTS

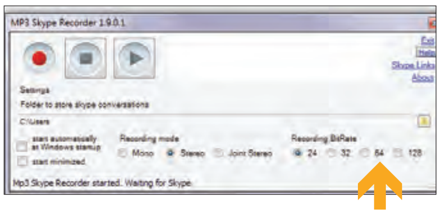
Previous Item	Ctrl + B
Next Item	Ctrl + F
Shuffle On/Off	Ctrl + H
Play or Pause	Ctrl + P
Stop	Ctrl + S
Rewind	Ctrl + Shift + B
Fast Forward	Ctrl + Shift + F
Fast Play Speed	Ctrl + Shift + G
Normal Play Speed	Ctrl + Shift + N
Slow Play Speed	Ctrl + Shift + S

Skype

From recording your calls to integrating Skype with instant messaging, we've got you covered

STOP BUGGING ME

Eliminate the annoying advertisements and information boxes that Skype slaps onto the bottom of its main window by clicking the Alerts & Messages sub-menu below the Notifications section on your Options panel, and then uncheck both "Help and Skype Tips" and "Promotions."



RECORD YOUR CALLS

Pamela (www.pamela-systems.com) is a paid-for application that allows you to record your Skype calls with a simple button press. It's great, but it costs money, so we prefer MP3 Skype Recorder (www.voipcallrecording.com) instead. This free app allows you to record Skype calls of any length—either automatically or manually—and output conversations as compressed MP3 files.

ONE FREE SKYPE NUMBER, COMING UP!

Web service Ring2Skype (www.ring2skype.com) is an excellent way to bypass the fees that Skype would normally charge you to have a dedicated phone number. In a nutshell, a dedicated Skype number—otherwise known as an Online Number—allows anyone in the world to dial you directly on your PC. Their call goes through on their phones and you receive the rings on your Skype client. Ring2Skype essentially gives you a number with a unique extension—when your friends dial that up, the service will route the call to your normal Skype user ID.

PIDGIN INTEGRATION

If you use Pidgin, you can integrate this multipurpose desktop instant-messaging client with your existing Skype client. It's not quite seamless—Skype has to be open and running on your system in order to have your friends show up in your Pidgin list—but it works.

A WEB-BASED SKYPE?

We're beginning to appreciate the web service imo.im more and more. This site presents you with an impressive collection of messaging services that you can sign into via one unified web portal. The service integrates perfectly with Skype; you can still access all the contacts on your account and send them messages, but most importantly, you can call up video and voice chats at the touch of a button. Definitely worth checking out at www.imo.im.

AUTOMATIC ANSWERING

Hey, sometimes you just don't feel like answering the phone. That's OK—there's an easy way around this with Skype thanks to the Skype-autoanswer plugin. Add a buddy to your auto-answer list, and Skype will do just that: Pick up the phone or, if you prefer, initiate a video chat with a person as soon as the app detects that said person is ringing you up. This is the perfect add-on if you just want to dial up your home PC and check out what's happening via your webcam.

TWITTER

Essential tips to better tweeting

TWITTER TO GOOGLE READER You can use the application GTweet (gtweetapp.appspot.com) to bounce all of your Twitter-based information to your Google Reader account. This web app is useful for folks who would otherwise like to keep their information all in one place. It mimics Twitter's default functionality to a T, and a premium version of the free web app offers even more interesting features to check out.

TWITTER MEETS FIREFOX? Fear not, Firefox users, you are not forgotten. Twitterbar's Firefox add-on is a pretty unique extension, in that it allows you to send messages directly via Firefox's address bar. Even better, the extension tells you just how many characters you have left in the address-bar message, which is just as good as the functionality offered by Twitter itself.

TWITTER AND... POWERPOINT? You can add the power of Twitter to any PowerPoint thanks to the helpful tools at www.sapweb20.com. Grab Timo Elliott's PowerPoint add-ons and you'll be able to generate real-time slides based on information pulled right out Twitter.

GAUGE THY POPULARITY The web app Mentionmap (www.asterisq.com) is great for seeing just how much your small life updates have made an effect on your general body of followers. Fire up the app and you'll see just how many people have @mentioned you in response to one of your Twitter updates. Now, click on their information, and you can repeat the process through a huge chain of people to see, without a shadow of a doubt, just who's talking about whom.

Mentionmap allows you to visually sort your own personal Twitter-verse.



Microsoft Word

Access a few of the deeper levels of mastery with our help

BE SELECTIVE WITH HOW YOU SELECT

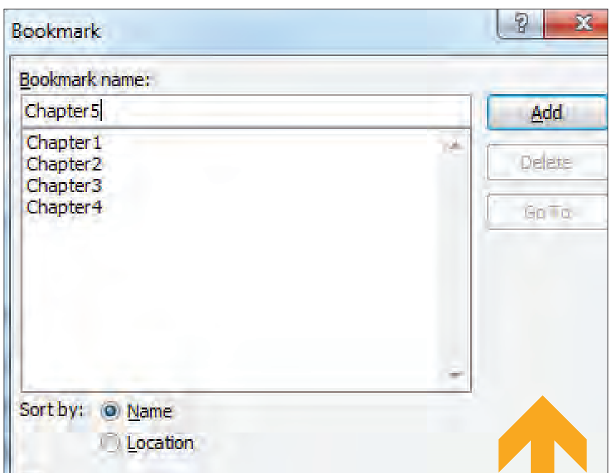
You already know that double-clicking selects a single word, and you probably figured out that triple-clicking selects an entire paragraph. But if you just want to select a single sentence, hold down Ctrl and click any word. To select an entire table, hold down Alt and double-click.

ADD A COMMENT BOX

When a friend or family member sends you a document to proofread, don't waste your time writing a lengthy email detailing all the horrendous mistakes you found; mark up their Word file instead. Highlight a portion of text, click the Review tab in the Ribbon bar, and select New Comment.

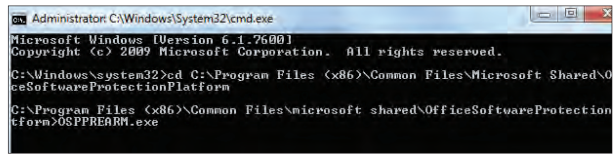
INSERT BULLETS AND NUMBER LISTS USING YOUR KEYBOARD

When inspiration hits, lifting your fingers off the keyboard to use your mouse can mess up your mojo, but what do you do if you need to insert a bullet or numbered list? It's simple: Type an asterisk and hit the spacebar to auto-create a bullet list. You can do the same with numbers and dashes.



HOP BACK AND FORTH WITH BOOKMARKS

To add a bookmark in Word, position your cursor and go to Insert > Links > Bookmark. Give your bookmark a name and click Add. To jump back to that point, just go back to the Bookmark menu, highlight your entry, and click Go To.



EXTEND WORD'S TRIAL PERIOD

Microsoft allows you to test-drive Office 2010 free for 30 days; after that, you have to pony up for a license and activate. Or you can 're-arm' Office for another 30-day trial, up to five times for a total of 180 days. To re-arm, open an elevated command prompt and go to `C:\Program Files\Common Files\Microsoft Shared\OfficeSoftware-ProtectionPlatform` and run `OSPPREARM.exe`. If you installed the 32-bit edition of Office on a 64-bit OS, replace `Program Files` with `Program Files (x86)`.

USE THE BUILT-IN THESAURUS

You don't need to hop online to use a thesaurus, the folks in Redmond had the good sense to bundle one in Word. To use it, highlight an entry and press Shift + F7. Pretty simple, right? Or maybe we should say it's trouble-free, straightforward, effortless, uncomplicated, or painless.

BACKUP/TRANSFER YOUR SETTINGS

Nearly every customization you make to Word gets saved in the Normal.dot template, a hidden file that you should keep backed up. You'll find it by navigating to C:\Users\[username]\AppData\Roaming\Microsoft\Templates. Be sure to enable viewing of hidden files, folders, and drives.

INSERT SCREENSHOTS INTO WORD

One of our favorite new features in Word 2010 is the ability to glue screen grabs right into the document we're working on. Just use the Print Screen key as normal to grab an image, and then go to Insert > Illustrations > Screenshot.

SELECT TEXT VERTICALLY

Did you mess up your numbered list? Maybe some funky symbols got placed at the beginning of each sentence when you copied over an email. Whatever your reason for wanting to select text vertically, you can do so by holding down the Alt key and using your mouse cursor.

PASSWORD PROTECT WORK DOCUMENTS

One of these days, you're going to punch your obnoxious roommate square in the face for digging around your personal documents. Or better yet, just lock your docs. To password protect a Word document, click File > Info > Protect Document > Encrypt with Password.

Microsoft Excel

Synergize your data-crunching paradigm with these handy tips

CONDITIONAL FORMATTING IS YOUR FRIEND

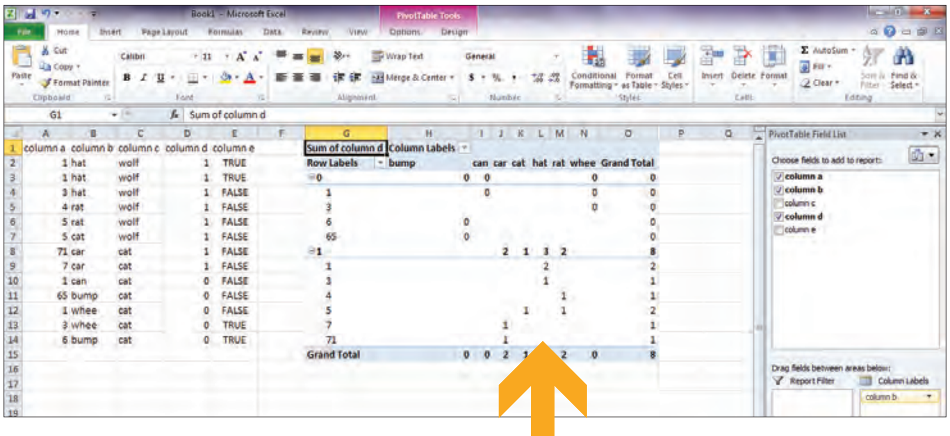
If formulas aren't your thing, here's an easy way to duplicate data between two columns. Highlight the columns and select Excel's Conditional Formatting feature on the Home tab. Then, select the Highlight Cells Rules listing and pick whatever option fits your style. Duplicate Values, for example, would highlight all repeated instances with a given color.

WHY NOT NUMBERS?

From time to time, Excel will foolishly store numbers as text instead of a numeral, which can be a real pain if you're trying to do anything with that information. So, how do you fix 23,414 rows of the same error? Insert a new column and type a "1" into an empty cell. Select it, copy it to your clipboard, then select the range of numbers you're looking to fix. Click the drop-down menu under the Paste icon, click Paste Special, and select the options "Values" and "Multiply."

DELETE BLANK ROWS

If you have a bunch of data that's separated by blank rows of cells for whatever reason, it's easy to just nuke these from your dataset forever without having to do any kind of crazy sorting. Select a column, hit F5, click Special, then select the Blanks option. With the blank rows now targeted, click over to Excel's Home tab, select Delete, and choose the option for eliminating rows.



TIME TO PIVOT

Pivot Tables are one of Excel's most useful—and misunderstood—features. Here's a quick lesson: Click within a chunk of data, click Insert, and select Pivot Table. Excel should automatically pick the entire range of that data (provided you don't have any blank columns interrupting your dataset), and convert it into an editable, table-as-you-go kind of setup. You can use the various "fields" on Excel's new sidebar to basically create new tables of information (and calculations) on the fly.

SHOW THY FORMULAS

This one's quick, but super-effective: If you have a spreadsheet full of formulas and you want to see exactly how you've built all of your constructions, you can do this by hitting Ctrl + ~, which will instantly transform your spreadsheet from values to the formulas that constructed them.

ADDING MULTIPLE LINES OF TEXT

It's frustrating to try to add multiple lines of text to a given cell. How the hell do you do it? The answer is so easy, it's almost shocking. When you want to insert a line break in a cell to split your text up in a more readable fashion, just hold down Alt and hit Enter. Technically, you're also turning on Wrap Text for the affected cell.

EMAIL... ANYTHING!

Check out the Excel plugin RDBMail (http://bit.ly/eq7015) if you want to super-charge your ability to quickly email portions of a worksheet to an Outlook recipient. It adds a new tab to your Ribbon that you can use as a single-click utility for emailing your entire worksheet or just the pertinent parts that you've selected. You can also toggle between sending the worksheet as-is—formulas included—or sending off only the values of what you've been working on.

DOUBLE-CLICK TO FREEDOM!

Double-clicking various components of the Excel interface can automate a number of functions, including double-clicking the Jewel to close Excel; selecting multiple columns and double-clicking the separators to auto-adjust the widths of all; double-clicking the tabs of Excel's Ribbon menu to minimize the whole thing; double-clicking the lower-right corner of a cell to Fill Down its contents based on the contents of the column to its left; and the list goes on. When in doubt, double-click.

NEW GPUs COME OUT SWINGING

Watch Them Battle to the Death!



Asus ENGTX570

VS

XFX Radeon HD 6970



PLUS FOUR MORE ACTION-PACKED FIGHTS!

★ XFX Radeon HD 5770 **VS** Asus ENGTS450 DirectCU

★ XFX Radeon HD 6850 **VS** Asus ENGTX460 TOP 768MB

★ Asus Radeon HD 6870 DirectCU **VS** Asus ENGTX460 TOP 1GB

★ HIS Radeon HD 5970 **VS** EVGA GeForce GTX 580 SC

BY LOYD CASE

A new generation of GPUs from Nvidia and AMD has hit the streets. Both camps are offering incredible performance and the widest array of features ever before seen in graphics cards. But, inevitably, each side brings its own unique strengths and weaknesses. What better way to determine the performance champ than by letting this season's new crop of cards duke it out in the various price categories?

On one side is AMD, the self-proclaimed master of efficiency, looking to hold onto the glory it grabbed when it shipped the original Radeon HD 5870—a surprise contender that knocked former champ Nvidia to the canvas at the time by offering DirectX 11 feature sets at impressive performance levels without requiring a nuclear reactor to power it.

On the other side is Nvidia, looking to score a comeback. When Nvidia finally shipped its long-awaited Fermi, it managed to retake the performance crown, but with an asterisk next to the record, since it was forced to ship an incomplete chip that required massive power draws. Even then, AMD's GPUs stayed close, while its dual-GPU HD 5970 dominated performance overall—but only when games took advantage of AMD's CrossFire X dual-GPU capability.

Now it's rematch time—a day of reckoning between the shiny, redesigned, and ready-to-rumble Fermis from Nvidia and AMD's new Radeon HD 6000 series. While Nvidia's new parts are streamlined versions of the original Fermi, more efficient and full-featured, AMD's new GPUs have been completely re-architected from scratch. Can new AMD designs deliver a winning blow to Nvidia's modernized GPUs?

The fight card includes battles in every price class, featuring a representative selection of cards. Contenders will be hit with a boatload of different games and benchmarks, as well as power-draw tests.

Whether they end in close calls or clear KOs, the results of these bouts will determine the videocard you choose for your next rig. Let's take this party ringside, shall we?

The Technical Decision

What features and capabilities to look for in today's graphics contenders

If you're looking for a graphics card today, the decision is more difficult than ever. The two primary suppliers of graphics processors, AMD and Nvidia, have taken decidedly different paths, even as they add more robust support for new graphics and GPU-compute programming interfaces.

DIRECTX 11 Both AMD and Nvidia support Microsoft's latest DirectX 11 graphics standard. So far, all DirectX 11 games have run well on both, though some run faster on Nvidia and others faster on AMD. So, you can feel comfortable that either AMD or Nvidia should be fine if you're looking to run the latest games.

DISPLAY SUPPORT On the AMD side, the Radeon HD 6000 line of graphics chips continues to support a minimum of three displays with a single card, just as the older HD 5000 series did. However, all HD 6000 cards have DisplayPort 1.2 built in. What that means is that monitors with DisplayPort 1.2 support can be daisy-chained, so that one card can drive up to six LCD panels. Nvidia's support for DisplayPort has been lukewarm on consumer graphics cards, but individual card manufacturers have occasionally added DisplayPort connectors. Almost all monitors still ship with DVI connectors, though, so if you're running one or two monitors, you're in good shape with a single Nvidia card.

STEREOSCOPIC 3D AMD has just begun adding stereoscopic 3D capability; the new Radeon HD 6000 series cards support stereoscopic 3D. In both games and Blu-ray movies, though, glasses must be obtained from third parties. Nvidia's 3DVision offers robust stereoscopic 3D support, provided you've also got a PC monitor capable of running at the required 120Hz refresh rate. In addition, if you're running an SLI setup, you can use 3DVision across three monitors, and the effect can be pretty startling. A system with an Nvidia card can connect to an HDTV and allow that TV's native stereoscopic capability to work with the PC.



Nvidia has a clear lead in terms of 3D movies and games. AMD needs to catch up.

GPU COMPUTE If you're into GPU-compute applications, Nvidia still has the edge here. While newer applications are moving toward multi-vendor standards like DirectCompute and OpenCL, a large library of applications exists for Nvidia's proprietary CUDA GPU-compute architecture, including the recently released Adobe Premiere Pro CS5's Mercury Playback Engine.

PHYSICS Nvidia has worked mightily to get game programmers to incorporate its PhysX technology, but only a few games really support it well. We're starting to see more open APIs that support OpenCL, like Bullet Physics, arrive on the scene. Already, 3DMark 2011 is shipping with Bullet Physics support, and it's likely we'll see a variety of new games ship with Bullet Physics.

POWER CONSUMPTION Nvidia's made some substantial strides in improving power efficiency, but cards using AMD GPUs still tend to consume less power. If you can save $50 a year in electricity, that could mean an additional game you can buy.

HD VIDEO ENCODING While both cards support HD video decoding, AMD's third-generation Unified Video Decoder (UVD3) offers hardware decoding of key HD codecs, including VC-1 and H.264. It also handles MPEG-2 and MPEG-4 Part 2, including DivX and xVid in hardware. AMD also supports hardware-accelerated transcoding in its fixed-function UVD3, with the ability to convert H.264 and MPEG-2 1080p streams to a different H.264 or MPEG-2 target bitrate and resolution.



Both AMD and Nvidia are strong players when it comes to DX11 games.

Featherweights

In terms of sheer volume, cards under $150 sell better than all the higher-price categories. For the most part, these cards are suitable for light gaming, home-theater PCs, and general-purpose computers that need some GPU-compute capability.

XFX Radeon HD 5770



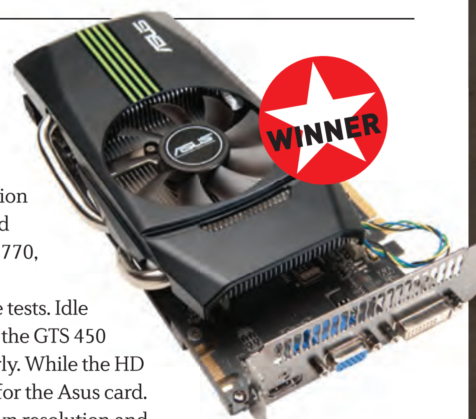
The Radeon HD 5770 is AMD's only GPU that hasn't been recently updated; it's still based on AMD's first DX11 architecture.

The XFX card fully supports AMD's Eyefinity feature, offering four total video attachments: a pair of dual-link DVI ports, one DisplayPort connector, and an HDMI port. Three can be active simultaneously, so you can have full triple-monitor support with a single card. The card we tested is the standard dual-slot design. XFX also offers a single-slot version of the card, suitable for tight cases, but that model is priced above $150.

This card is 8.5 inches long, so will fit in most PC cases, and takes just a single 6-pin power connector. You'll want a 450W PSU. As with all recent-generation AMD GPUs, it fully supports HDMI multichannel-audio pass-through. One of the real strong suits of XFX cards is the robust, limited lifetime warranty if you register the card. This warranty can even be passed on to a single buyer if you resell the card.

VERDICT **7**
XFX HD 5770
$130, www.xfxforce.com

Asus ENGTS450 DirectCU



Call this the littlest Fermi. The Asus ENGTS450 is built on Nvidia's GTS 450 GPU, a scaled-down version of Nvidia's flagship architecture. The GTX 450 is its own chip, not a feature-reduced version of a large GPU. Asus's GTS 450 card includes only a single dual-link DVI connector, plus VGA and HDMI outputs; only two can be simultaneously active. This is a newer design than the XFX HD 5770, launched in September 2010.

The Asus card wins in seven of 12 total benchmarks, while scoring five wins out of nine game tests. Idle power draw proved lower, too, although the Radeon GPU was more efficient under load. Note that the GTS 450 GPU is Nvidia's first design to properly support full multichannel HDMI audio pass-through properly. While the HD 5770 offers some intriguing features, we'll call this a TKO for the Asus card.

Note that in many games, you'll still need to dial down resolution and graphics settings, particularly on bleeding-edge titles. That's the trade-off with a sub-$150 card over the pricier spread.

VERDICT **8**
ASUS ENGTS450
$130, www.asus.com

SPECS

	XFX RADEON HD 5770	ASUS ENGTS450
Shader Units*	800	192
Texture Units	36	32
ROPs	16	16
Power Connectors	1 x 6-pin	1 x 6-pin
Core Clock	850MHz	783MHz
Shader Clock	NA	1,566MHz
GDDR5 Memory Clock	1.2GHz	900MHz
GDDR5 Frame Buffer	1GB	1GB
Memory Interface	128-bit	128-bit

*AMD and Nvidia computer cores are not directly comparable.

BENCHMARKS

	XFX RADEON HD 5770	ASUS ENGTS450
3DMark 2011	**2,688**	2,486
3DMark Vantage	11,231	**11,498**
Unigine Heaven 2.1 (fps)	11	**14**
Crysis (fps)	**17**	15
Battle Forge (fps)	24	**26**
Far Cry 2 (fps)	47	**52**
F1 2010 (fps)	**37**	28
HAWX 2 (fps)	47	**67**
Metro 2033 (fps)	8	**9**
STALKER: CoP (fps)	20	**23**
Just Cause 2 Concrete Jungle (fps)	23	23
Aliens vs. Predator (fps)	16	16
Power@ idle (W)	150	**127**
Power @ full throttle (W)	**224**	257

Best scores are bolded. Our test bed is a 3.33GHz Core i7-975 Extreme Edition in an Asus P6X58D Premium motherboard with 6GB of DDR3/1333 and an 850TX Corsair PSU. The OS is 64-bit Windows Ultimate. All games are run at 1920x1200 with 4x AA.

Lightweights

Now we're starting to get to some gaming meat. Cards costing between $150 and $200 offer substantially better gaming performance than lower-cost cards. These mainstream gaming cards won't punish your wallet, yet you should be able to get good gaming performance on a 1080p display.

XFX Radeon HD 6850



AMD's Radeon HD 6850 had some big shoes to fill. The original Radeon HD 5850 delivered surprisingly good performance in its price class for the time. However, the new HD 6850 doesn't quite deliver the goods, though it's still a capable card in its own right. The robust XFX warranty plus AMD Eyefinity make this an attractive card, but the competition's price drop pulls down the score a bit.

The HD 6850 did win four of our 11 game tests and tied the 768MB GTX 460 in two, so we'll call it a TKO. It's somewhat better, on average, than the 768MB GTX 460, but costs more. On the other hand, three fully functional display connectors make this a great card for gamers who want three displays for productivity apps.

One distinguishing feature of the card is power efficiency, consuming 133W at idle (just a tad more than the 768MB GTX 460), but a scant 218W in our full-throttle load test. The card was overall a touch quieter than the Asus card, as well. This could be the core of a solid home-theater PC that's also capable of high-definition gaming.

VERDICT: 8
XFX HD 6850
$190, www.xfxforce.com

Asus ENGTX460 TOP 768MB



The 768MB version of Nvidia's GTX 460 is a strange beast. Some models can actually be found for less than $150, though this overclocked Asus card tends to be priced closer to $170. The 192-bit memory interface and sub-1GB frame-buffer size seem a little lightweight for its class. Asus beefs up its version with its DirectCU heatsink technology and slightly higher clock speeds, pushing performance a bit higher.

As a result, its performance is generally on par with the newer Radeon HD 6850. So maybe it's in the right class after all, though we still worry about that memory interface.

As with all Asus DirectCU cards, the 768MB 460 GTX model ships with the company's VoltageTweak utility. Output connectors consist of two dual-link DVI and one mini-HDMI port.

VERDICT: 7
ASUS ENGTX450
$170, www.asus.com

SPECS

	XFX RADEON HD 6850	ASUS ENGTX 460
Shader Units*	960	336
Texture Units	48	56
ROPs	32	24
Power Connectors	2 x 6-pin	2 x 6-pin
Core Clock	775MHz	700MHz
Shader Clock	NA	1,400MHz
GDDR5 Memory Clock	1,000MHz	920MHz
GDDR5 Frame Buffer	1GB	1GB
Memory Interface	256-bit	192-bit

*AMD and Nvidia computer cores are not directly comparable.

BENCHMARKS

	XFX RADEON HD 6850	ASUS ENGTX460
3DMark 2011	**3,596**	3,201
3DMark Vantage	**14,292**	13,737
Unigine Heaven 2.1 (fps)	16	**18**
Crysis (fps)	**24**	19
Battle Forge (fps)	36	**38**
Far Cry 2 (fps)	68	68
F1 2010 (fps)	**46**	36
HAWX 2 (fps)	68	**85**
Metro 2033 (fps)	9	**15**
STALKER: CoP (fps)	**28**	25
Just Cause 2 Concrete Jungle (fps)	30	30
Aliens vs. Predator (fps)	**23**	21
Power@ idle (W)	133	**128**
Power @ full throttle (W)	**218**	248

Best scores are bolded. Our test bed is a 3.33GHz Core i7-975 Extreme Edition in an Asus P6X58D Premium motherboard with 6GB of DDR3/1333 and an 850TX Corsair PSU. The OS is 64-bit Windows Ultimate. All games are run at 1920x1200 with 4x AA.

Middleweights

If you're willing to drop up to $300 on a graphics card, you can expect something that's pretty bleeding-edge, with solid gaming performance and lots of features.

Asus Radeon HD 6870 DirectCU



WINNER

At just less than $250, the Asus variant of AMD's Radeon HD 6870 delivers excellent performance. While it is somewhat overshadowed by its newer cousin, the HD 6950, it costs considerably less than that part. If you do most of your gaming on a single 1080p display, this card won't disappoint.

Even though Asus only pushes the clock rate slightly—915MHZ versus the stock 900MHz— the finned backplate gets pretty warm after a stiff gaming session. This card also shows one of the key weaknesses of Asus's DirectCU cooler—it's noticeably more noisy than a standard HD 6870.

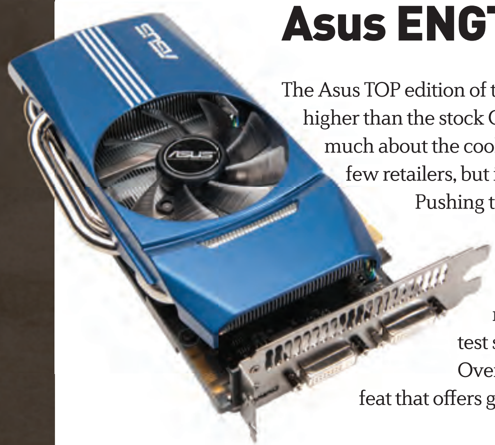
On the other hand, unlike cards built on AMD's reference design, the HD 6870 DirectCU ships with two full-size DisplayPort connectors, plus one dual-link DVI and one single-link DVI port. And if you crave an HDMI connection, the card comes with a DVI-to-HDMI adapter. System idle power was 140W, while the full-throttle power draw was just slightly over 250W.

In the end, Asus delivers a unique take on the Radeon HD 6870 while keeping the price to a reasonable level. If you have a well-ventilated case, the feature-rich HD 6870 DirectCU is the clear winner in this matchup.

MAXIMUMPC KICK ASS!

VERDICT
ASUS HD 6870 DIRECTCU
$250, www.asus.com
9

Asus ENGTX460 TOP 1GB



The Asus TOP edition of the GTX 460 adds its now-familiar DirectCU cooling engine and pushes the clock speed a full 100MHz higher than the stock GTX 460's 675MHz. That's a 15 percent overclock. That, plus the 11 percent memory overclock, says as much about the cooler design as the GPU. However, that also raises the price. You can find this card for less than $210 at a few retailers, but it's more likely to be around $220.

Pushing the GTX 460 this hard pays off dividends. Asus's TOP card delivers impressive performance, but even that 100MHz overclock can't quite keep up with the HD 6870.

In other respects, the card's design is pretty standard: two dual-link DVI connectors plus a Mini-HDMI port handle output chores (only two can be active at once). The card supports SLI (two cards maximum) for additional performance. Note that the maximum power draw approached 300W in our test system, which is pretty high for a sub-$300 card.

Overall, the Asus GTX 460 1GB TOP is an impressive engineering feat that offers good gaming performance without hammering your wallet.

VERDICT
ASUS ENGTX460 DIRECT TOP
$220, www.asus.com
8

SPECS

	ASUS RADEON HD 6870 DIRECTCU	ASUS ENGTX460 TOP 1GB
Shader Units	1,120	336
Texture Units	56	56
ROPs	32	32
Power Connectors	2 x 6-pin	2 x 6-pin
Core Clock	915MHz	775MHz
Shader Clock	NA	1,550MHz
GDDR5 Memory Clock	1,050MHz	1,000MHz
GDDR5 Frame Buffer	1GB	1GB
Memory Interface	256-bit	256-bit

AMD and Nvidia computer cores are not directly comparable.

BENCHMARKS

	XFX RADEON HD 6870 U DIRECT CP	ASUS ENGTX460 TOP 1GB
3DMark 2011	**4,314**	3,963
3DMark Vantage	**17,041**	16,226
Unigine Heaven 2.1 (fps)	18	18
Crysis (fps)	**29**	23
Battle Forge (fps)	**42**	40
Far Cry 2 (fps)	78	**83**
F1 2010 (fps)	**54**	43
HAWX 2 (fps)	77	**101**
Metro 2033 (fps)	**20**	15
STALKER: CoP (fps)	34	**35**
Just Cause 2 Concrete Jungle (fps)	35	35
Aliens vs. Predator (fps)	**26**	21
Power@ idle (W)	140	**133**
Power @ full throttle (W)	**252**	298

Best scores are bolded. Our test bed is a 3.33GHz Core i7-975 Extreme Edition in an Asus P6X58D Premium motherboard with 6GB of DDR3/1333 and an 850TX Corsair PSU. The OS is 64-bit Windows Ultimate. All games are run at 1920x1200 with 4x AA.

Heavyweights

Once you go north of $300, you're getting into some rarified atmosphere. This is the arena for AMD's top single-GPU card and Nvidia's second-to-top card. It's the fight that matters to most power users.

XFX Radeon HD 6970



We're not sure why this card isn't faster than it is. In many ways, it's two HD 6870s built onto one chip, but overall throughput may be hobbled by having only 32 ROPs and a 256-bit memory interface. Overall performance is nowhere near double an HD 6870, and the card beats the GTX 570 in only five of 12 benchmarks. The HD 6870's power draw is a bit lower, but only marginally so. If we had to hazard a guess, it's likely that AMD still has significant driver work to do to realize the full potential of the HD 6970.

If you look at the benchmark spreads, it's essentially an even match between the XFX card and the GTX 570; it's only the super-tessellated HAWX 2 that shows a huge margin, and even then, the HD 6970 is pumping out an impressive 81fps.

There are other things to like about the XFX HD 6970, too. Two Mini DisplayPort connectors fully support DisplayPort 1.2, which will let the card take full advantage of up to six monitors via daisy-chaining, once new LCDs supporting DisplayPort 1.2 ship.

All that aside, for purely gaming purposes, it's tough to recommend the HD 6970 over the lower-cost GTX 570 card. Driver updates and price drops could shift our opinion.

VERDICT **8**
XFX RADEON HD 5770
$380, www.xfx.com

Asus ENGTX570



The GTX 570 is the little brother of Nvidia's current high-end GTX 580. Like the original GTX 480, the GTX 570 has 480 shader cores active, and 32 disabled. Since it's based on the GTX 580 GPU, however, Nvidia's able to run the GTX 570 at a higher clock rate than the GTX 480. On the other hand, the memory controller is 320 bits wide, versus the GTX 480's 384-bit controller. That's still wider than the 256-bit memory bus on the Radeon HD 6970.

The Asus ENGTX570 is pretty much a reference card, although it runs the GPU core just a bit above reference clock, at 742MHz (versus 732MHz for Nvidia's reference design). Memory weighs in at 1.2GHz running at the default 950MHz. Also standard are a pair of dual-link DVI D-shells plus a Mini-HDMI port.

At $355, the ENGTX570 costs about $25 less than the XFX HD 6970, but wins in seven of 12 benchmarks. It's slightly quieter as well, even though it uses more power at idle and full throttle than the AMD-based XFX card.

So, it really comes down to a trade-off. Performance between the cards is relatively similar, but feature sets differ. Asus supports Nvidia's 3DVision stereoscopic 3D technology and PhysX accelerated physics, while the HD 6970 offers robust video decode and AMD's Eyefinity multi-display technology. We lean toward the ENGTX570 for gamers.

VERDICT **9**
ASUS ENGTX570
$355, www.asus.com

SPECS

	XFX RADEON HD 6970	ASUS ENGTX570
Shader Units*	1,536	480
Texture Units	96	60
ROPs	32	40
Power Connectors	1 x 8-pin, 1 x 6-pin	2 x 6-pin
Core Clock	880MHz	742MHz
Shader Clock	NA	1484MHz
GDDR5 Memory Clock	1,375MHz	950MHz
GDDR5 Frame Buffer	2GB	1282MB
Memory Interface	256-bit	320-bit

*AMD and Nvidia computer cores are not directly comparable.

BENCHMARKS

	XFX RADEON HD 6970	ASUS ENGTX570
3DMark 2011	5,313	**5,316**
3DMark Vantage	20,443	**21,299**
Unigine Heaven 2.1 (fps)	27	**30**
Crysis (fps)	**36**	33
Battle Forge (fps)	47	**65**
Far Cry 2 (fps)	94	**105**
F1 2010 (fps)	**65**	62
HAWX 2 (fps)	81	**144**
Metro 2033 (fps)	**22**	21
STALKER: CoP (fps)	**53**	49
Just Cause 2 Concrete Jungle (fps)	41	**46**
Aliens vs. Predator (fps)	**40**	36
Power@ idle (W)	**139**	144
Power @ full throttle (W)	**331**	339

Best scores are bolded. Our test bed is a 3.33GHz Core i7-975 Extreme Edition in an Asus P6X58D Premium motherboard with 6GB of DDR3/1333 and an 850TX Corsair PSU. The OS is 64-bit Windows Ultimate. All games are run at 1920x1200 with 4x AA.

Super Heavyweights

Once prices surpass $500, most mortal users lose interest. Only the truly fanatical want to spend more than the cost of a modest laptop on a single graphics card.

HIS Radeon HD 5970



Performance on the HD 5970 depends heavily on how well AMD's dual-GPU CrossFire X drivers work. The good news is that AMD's driver support for dual-GPU capability has improved dramatically in the past year. The downside: You'll need to update CrossFire X profiles every few weeks as new games come out. (It's not just an AMD problem, either. Nvidia's SLI feature suffered from a bug in the last driver release that limited performance in some cases.)

Even with the raw GPU capability of two Radeon HD 5800 series GPUs, AMD only managed to pull off wins in seven of 12 benchmarks. Then there's the price. Typical prices for Radeon HD 5970 cards start at $580, and many are priced well north of $600.

If you're into gaming using AMD's Eyefinity multi-display feature, the HD 5970 is your card, delivering reasonable frame rates even on three 1080p displays. And you can add a second HD 5970, though the performance gain with that fourth GPU will be limited. Another problem with the card is that it's so big that it simply won't fit in the majority of PC cases. Be sure to check the depth behind your primary PCI Express slot before buying.

In the end, the HD 5970 is an impressive engineering achievement, but its complexity may be its Achilles' heel.

VERDICT **9**
HIS HD 5970
$580, www.hisdigital.com

EVGA GTX 580 SC



WINNER

It's a familiar story. EVGA takes the high end of Nvidia's GPU line, pushes up the clock speed a few percentage points, adds a little extra to the price, and the net result is a really, really speedy graphics card. The company's limited lifetime warranty (product registration required, North America only) lets you breathe a little easier; after all, you're spending $540 on a graphics card.

Even with only a single GPU, the EVGA card scored wins against the dual-GPU Radeon HD 5970 in five of 12 benchmarks. And in a bit of role reversal, the GTX 580 SuperClocked draws a little less power at idle than AMD's HD 5970 beast of a card, though system power does peak at 395W, the highest power draw in our roundup.

Output connectors are limited to two dual-link DVI ports plus a Mini-HDMI port. Note that the minimum recommended power supply needs to support a +12v current draw of 42A— make sure you have a good PSU. On the other hand, the card is a more standard 10.5 inches long—big, but not too big for most cases.

Overall, the EVGA GTX 580 SC is fast, polished, and well-mannered. Despite the large power draw at full load, the card never got overly loud. If you really want top-of-the-line, this is the card for you.

MAXIMUMPC KICK ASS!

VERDICT **9**
EVGA GTX 580 SC
$540, www.evga.com

SPECS

	HIS RADEON HD 5970	EVGA GTX 580 SC
Shader Units*	2 x 1600 (3,200 total)	512
Texture Units	2 x 80 (160 total)	64
ROPs	2 x 32 (64 total)	48
Power Connectors	1 x 8-pin, 1 x 6-pin	1 x 8-pin, 1 x 6-pin
Core Clock	725MHz	797MHz
Shader Clock	NA	1,594MHz
GDDR5 Memory Clock	1,000MHz	1,050MHz
GDDR5 Frame Buffer	2 x 1GB	1,536MB
Memory Interface	2 x 256-bit	384-bit

*AMD and Nvidia computer cores are not directly comparable.

BENCHMARKS

	HIS RADEON HD 5970	EVGA GTX 580 SC
3DMark 2011	**6,695**	6,105
3DMark Vantage	**24,654**	23,888
Unigine Heaven 2.1 (fps)	28	**36**
Crysis (fps)	**44**	36
Battle Forge (fps)	**73**	40
Far Cry 2 (fps)	114	**122**
F1 2010 (fps)	**80**	72
HAWX 2 (fps)	102	**158**
Metro 2033 (fps)	20	**26**
STALKER: CoP (fps)	54	**58**
Just Cause 2 Concrete Jungle (fps)	**55**	52
Aliens vs. Predator (fps)	**49**	44
Power@ idle (W)	169	**141**
Power @ full throttle (W)	**364**	395

Best scores are bolded. Our test bed is a 3.33GHz Core i7-975 Extreme Edition in an Asus P6X58D Premium motherboard with 6GB of DDR3/1333 and an 850TX Corsair PSU. The OS is 64-bit Windows Ultimate. All games are run at 1920x1200 with 4x AA.

Reviewing the Scorecard

Today's GPUs are faster than ever, but what's the future of the discrete GPU?

Let's take a moment to recap. If you're on a tight budget, or are building a home-theater PC focused on video performance, but still want a little gaming on the side, Nvidia's GTS 450 looks like a good bet, and the Asus ENGTS450 proves to be a capable card. If you can step up to $200, it's a tough choice between the XFX Radeon HD 6850 and the 768MB GTX 460, but we'd lean toward the HD 6850, although it does cost a little more.

Serious gamers with a little more coin can move up to the massively overclocked Asus ENGTX460 DirectCU or the Asus Radeon HD 6870 DirectCU. The HD 6870 costs a bit more, but delivers a little better overall performance in games, plus robust video playback and excellent support for multiple displays.

North of $300, the XFX Radeon HD 6950 and the Asus GTX 570 run neck-and-neck; we lean toward the GTX 570, but the different feature sets may sway you one way or the other. When you get to the really high-price spread, the EVGA single-GPU GTX 580 SC really shines, performing very well without the hiccups and complexities inherent to the massive dual-GPU Radeon HD 5970.

SO, WHAT'S NEXT?

Right now, PC gaming is a mixed bag. Some games, like F1: 2010 and Metro 2033, push the envelope, employing demanding effects that improve image quality, but at a big performance hit. Still, will games like these be enough to sustain ever-higher transistor counts and feature sets? The future of discrete graphics cards—particularly lower-priced cards—is starting to look a little murky, as AMD implements DirectX 11 GPU features into its Fusion APU processor and Intel builds better graphics into its CPU line. Will on-die graphics become fast enough to challenge midrange or high-end graphics cards? That's still an unknown.

Given the limited growth in feature sets of most PC games, it's no wonder that both companies are pushing hard for features that will suck more cycles out of the GPU. Stereoscopic 3D, like Nvidia's 3DVision, requires double the GPU performance to hit the same frame rates at the same resolution. AMD's Eyefinity requires massive horsepower if you want to drive 4 million pixels in 3D gaming. Given that most monitor resolutions have stagnated at 1080p, what else can they do?

One thing is sure: Today's GPUs may seem fast and impressive. Big frame buffers and fast frame rates rule the roost in most games. Will tomorrow's GPUs be even faster, and offer even better eye candy? Probably, and we'll be there to tell you which one is best.

HOME THEATER GRAPHICS

So, You Want to Plop a PC in Your AV Rack?

If you're interested in building a home-theater PC, a good GPU is a must. Today's high-definition content requires lots of bandwidth plus the dedicated video circuitry built into modern GPUs.

If all you're doing is playing back high-definition content, then an entry-level GPU is probably good enough. A card like the Asus ENGTS450 offers good video-decode performance and robust HDMI-audio pass-through capability. While a lot has been made of the video-decode and -encode capability of Intel's Sandy Bridge processor, codec support is limited to mainstream high-definition codecs. An entry-level GPU offers more options, like DivX acceleration. Entry-level GPUs tend to draw less power and generate less heat, which translates into an overall quieter HTPC.

You also need to consider the form factor. If you're really trying to build a compact, low-profile system, cards like the single-slot XFX Radeon HD 5770 or 5750 or the low-profile Asus ENGT430 look interesting. Just don't expect full-throttle 3D gaming with this class of cards, particularly in a rig with a constrained thermal environment.

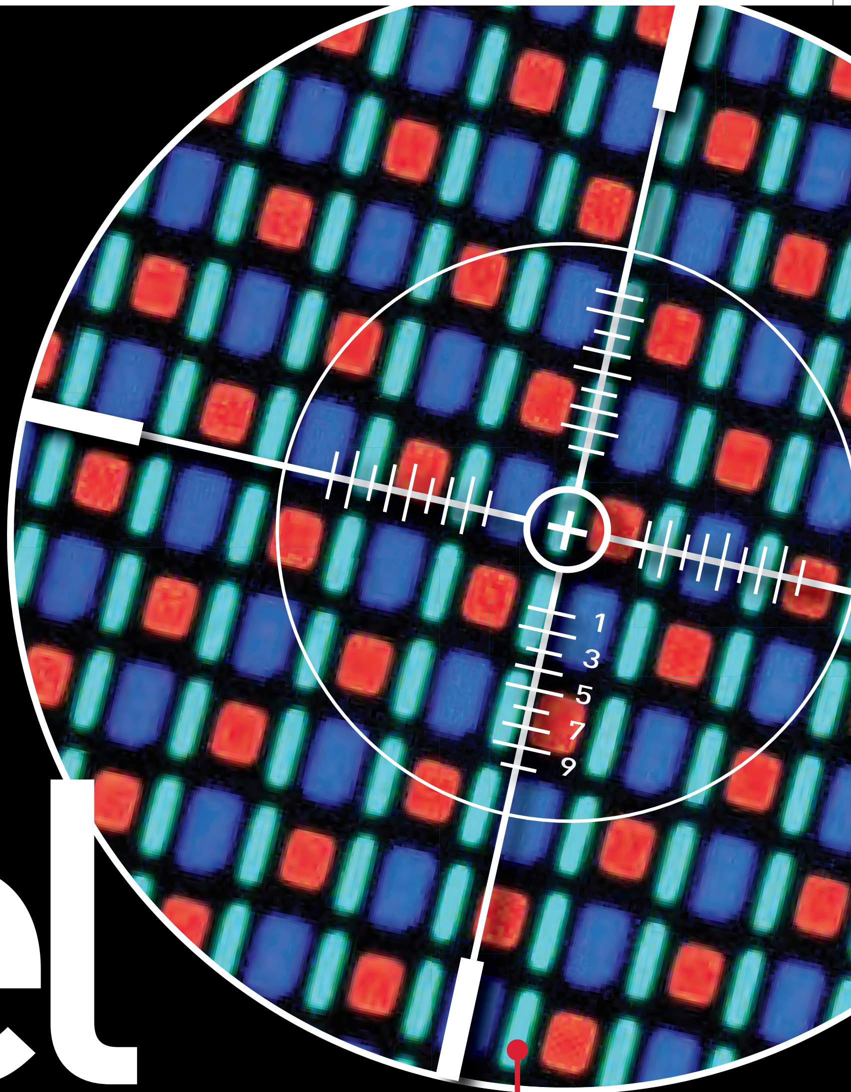


The relative quietude of XFX's Radeon 6850 makes it a good choice for an HTPC.

If serious gaming is desired, you need to step up to at least a midrange GPU. Here, it starts to get tricky. Some graphics card in this range can be noisy. For example, we thought the Asus ENGTX460 TOP 1GB card was the cats pajamas for gaming in its price class, but there's no denying that it's loud when it's working hard. We'd sacrifice a little performance, and maybe even spend a few more dollars for something like XFX's single-wide Radeon HD 6850, which is noticeably quieter.

A midrange GPU is also useful if you plan on taking advantage of emerging graphics technologies, like WebGL 3D browser capability. You'll want more horsepower than an entry-level GPU offers if you plan on stereoscopic 3D viewing and gaming, too.

IN SEARCH OF THE PERFECT PORTABLE Pixel

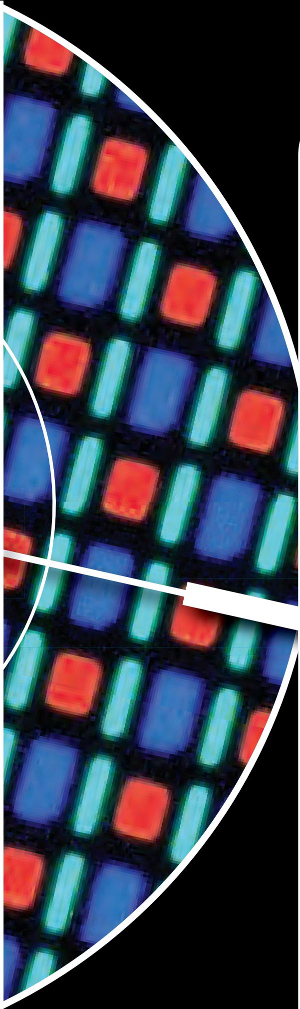


A microscope reveals the sub-pixel formations of an HTC Incredible's IPS LCD.

The perfect mobile display has yet to be invented—but that isn't stopping eight competing technologies in the quest for bragging rights BY MICHAEL BROWN

Every mobile display technology seems to promise the same benefits: Great readability, even in daylight. Fast pixel-transition speeds for displaying video. A wide color gamut for visual fidelity. And, of course, low power consumption for longer battery life.

Because competition is so fierce, every display manufacturer cloaks its offering with some silly trademarked name so you can't tell which technology it's actually based on. To mitigate the confusion, here's a look at the core technologies behind the trade names. We'll take a deep-dive into today's four most common mobile display types, and preview four up-and-comers showing promise.



A-SI TFT LCD

Amorphous silicon (a-Si) TFT is one of the most common iterations of basic LCD technology. It enjoys widespread adoption, and is found in devices large and small. Transistors fabricated from a thin film of amorphous silicon are arranged in a matrix of rows and columns on a polarized glass substrate. A layer of liquid crystals is placed on top of the transistors, and a second sheet of glass—polarized at a 90-degree angle to the first—is laid on top of that. To address an individual pixel, the relevant row of transistors is switched on, and then an electrical charge is sent down the intersecting column.



The N95 may be packed with Nokia's special brand of Finnish weirdness, but its a-Si TFT display is as average as they come.

When the transistor is switched on, the liquid crystals above it reorient themselves to allow light from the display's backlight to pass through. When the transistor is deactivated, the crystals flip back and block the light. Each transistor controls a single pixel, and color is achieved by dividing each pixel into three sub-pixels, colored red, green, and blue. Any color can be achieved by mixing these three sub-pixels, and color intensity can be changed by varying voltage.

A-Si TFT displays deliver good viewing angles and a relatively wide color gamut, but their backlights consume a lot of power and they're hard to read in direct sunlight—two huge drawbacks for battery-powered mobile devices. According to Paul Semenza, senior VP for DisplaySearch (www.displaysearch.com), a-Si TFT enjoys the best price/performance ratio of any current mobile display technology and should remain the market leader over the next three years.

LTPS TFT LCD

This technology is very similar to a-Si TFT LCD, except that its transistors are formed from grains of polysilicon (LTPS stands for low-temperature polysilicon). Because polysilicon grains are larger and more uniform than the random-size amorphous silicon grains, electrons can flow up to 100 times faster than they can through the grains of a-Si. This enables an LTPS display to respond much faster.

What's more, because the row/column driver electronics in an LTPS display are integrated into the glass substrate (as opposed to the surrounding screen area), the LTPS pixels can be placed much closer together, resulting in much higher maximum resolutions. All that said, LTPS LCDs aren't much easier to read in direct sunlight, and their backlights consume at least as much power as a-Si LCDs.

In terms of market share, DisplaySearch predicts LTPS will hold tight to second place over the next three years.

The Retina Display in Apple's iPhone 4 combines LTPS with in-plane switching technology (which we cover next). According to Dr. Raymond M. Soneira, president of DisplayMate Technologies (www.displaymate.com), "The iPhone Retina Display had the brightest and sharpest display" in tests he has conducted. Soneira also said, however, that the Retina Display's "color gamut is too small, producing under-saturated, somewhat washed-out colors, and its image contrast is too high, which produces punchier images and also partially compensates for its smaller color gamut."



Using LTPS technology, the "Retina Display" in Apple's iPod touch is well-suited for the high resolutions and frame-rate demands of HD movies.

IPS LCD

When voltage passes through the liquid crystals in an in-plane switching (IPS) LCD, the crystals move parallel to the panel plane rather than perpendicular to it, as they do in twisted-nematic LCDs. This endows the display with much better off-axis viewing angles, and explains why the technology is so popular for displays in phones and tablets (which must look great in both landscape and portrait modes).

Enhanced IPS panels use smaller transistors,



Samsung's Galaxy Tab uses a Samsung-branded "Super" version of IPS LCD technology. To superfy its display, Samsung integrates the tablet's touch-screen technology directly into the LCD (rather than into a separate layer atop the LCD), providing for a thinner package and potentially brighter screen.



Samsung has become synonymous with AMOLED deployment, as evidenced by the Epic 4G smartphone. Unfortunately, AMOLED is expensive, and the possibility of shortages has influenced configuration decisions among device manufacturers.

which means the apertures through which light passes are larger. Having a larger aperture enables the manufacturer to use a lower-power backlight, which extends battery life in handheld devices, although not by a wide margin.

Jin Kim, founder and president of DisplayBlog.com, says, "IPS will rule in tablets and eventually in notebook PCs, monitors, and TVs." And in the smartphone space, says Kim, "IPS will compete fiercely with OLED technology, especially from Samsung with its Super AMOLED."

AMOLED

In an AMOLED (active-matrix organic light-emitting diode) display, organic compounds emit light when activated by an electrical current. AMOLED requires a thin-film transistor backplane to turn each pixel on and off, but because the pixels emit light on their own, they don't require a backlight to produce an image. AMOLED displays also produce very deep black—a function of simply shutting off power to the appropriate pixels.

For its smartphones, Samsung manufactures a premium AMOLED display dubbed Super AMOLED. While DisplaySearch's Paul Semenza dismisses Samsung's "Super" designation as a move in a "marketing arms race," DisplayMate's Ray Soneira reports that "Super" OLEDs do indeed perform better than other OLEDs.

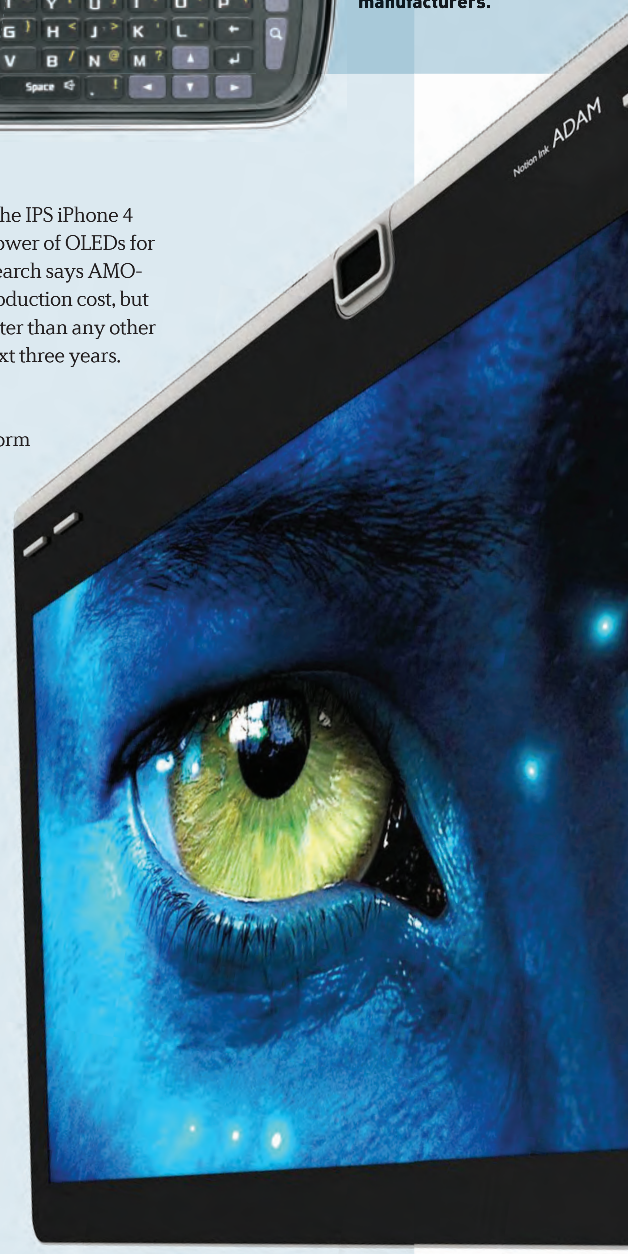
"In our lab tests," Soneira says, "the Galaxy S has a screen reflectance of 4.4 percent, and is 25 percent brighter and uses 21 percent less power than the 'non-Super' OLED in the Google Nexus One—meeting or exceeding all of Samsung's specs. Particularly impressive is the very low screen reflectance, which is among the lowest we have ever measured. Outdoors, it can have a significant impact on screen visibility."

Soneira, however, does point out that AMOLED isn't necessarily the be-all and end-all of power efficiency: "In our tests, the IPS iPhone 4 display used roughly half the power of OLEDs for the same brightness." DisplaySearch says AMOLED's biggest weakness is its production cost, but predicts AMOLED will grow faster than any other mobile display tech over the next three years.

MULTI-MODE LCD

Imagine a display that can perform like reflective electronic paper in one mode, and then a full-color LCD with the flip of a switch. That's what Pixel Qi (www.pixelqi.com) has achieved with its 3Qi display. Dubbed "multi-mode LCD" by industry watchers, this technology can be manufactured with the same fabrication machinery used in conventional LCD production, and can function like a conventional color LCD. But when its backlight is turned off, the display operates in a low-power, black-and-white reflective mode, rendering content that's visible in direct sunlight—just like a Kindle and other ebook readers.

Pixel Qi (pronounced "chee") currently offers a 10.1-inch display that delivers a resolution of 1024x768 in RGB transmissive mode, and 3072x600 in B&W reflective mode. Interested? Well, you might need to build your own tablet, notebook, or smartphone as a DIY project (kits are



Will the 3Qi-laden Adam ever ship? Notion Ink hopes to have the tablet ready for customers in early 2011.



Liquavista's electrowetting displays would be ideal for outside viewing, where traditional mobile screens often let us down.



mode Android device could be available for sale by the time you read this.

DisplaySearch rates Pixel Qi's display as inferior to a-Si LCD, LTPS LCD, and AMOLED in terms of viewing angle, color gamut (in transmissive mode), and maximum resolution. It does, however, give the technology high marks for its low power consumption and readability in sunlight (in reflective mode). Soneira, meanwhile, considers Pixel Qi "a very exciting and useful new technology that out-performs E Ink while also delivering the benefits of color LCD."

ELECTROWETTING

Electrowetting uses voltage to manipulate the movement of fluids in a confined space, typically a mixture of water and oil sandwiched between two plates of glass. As with Pixel Qi's technology, electrowetting displays can be fabricated using processes very similar to those used in existing LCD manufacturing.

Dye dissolved in the oil determines the color of the pixel. In the absence of voltage (the pixel's off state), the oil forms a film between the water and an electrode that's coated with a water-repellent insulation. When voltage is applied, the electrode changes the water's surface tension, drawing it down to the bottom plate so that it pushes the oil aside. This results in a semi-transparent pixel—so if the surface beneath the glass is white, you'll see a white pixel.

The transition between white and color is sufficiently fast for an electrowetting display to show full-motion video, giving the technology a significant advantage over other types of reflective displays, such as E Ink (used in Amazon's Kindle). Liquavista (www.liquavista.com), one of the early players in electrowetting, is targeting the ebook reader market with its first product. LiquavistaBright will be capable of producing a 64-step grayscale for text, graphics, and video. Liquavista's next iteration will add filters to produce a full-color version—unimaginatively dubbed LiquavistaColor.

DisplaySearch considers electrowetting to be inferior to LCD and AMOLED in terms of resolution and viewing angle, but far superior in terms of power consumption. "Liquavista could leapfrog over E Ink to bring the first color eReader technology to market," says Paul Semenza.

MEMS SHUTTER

MEMS stands for micro-electro-mechanical systems, a technology consisting of infinitesimally small hardware components ranging in size from 1 to 100 microns. MEMS shutters—one for each pixel—take the place of liquid crystals, opening to allow light to pass through, and closing to block light. The display still relies on a backlight, but because there are no liquid crystals, polarizers, or color filters (which absorb as much as 70 percent of the light before it reaches the eye), MEMS shutter displays can operate with backlights that consume much less power.

As implemented in the PerfectLight display from Pixtronix (www.pixtronix.com), color is produced by red, green, and blue LED backlights. The company maintains that its technology is capable of delivering 24-bit color, 105 percent of the NTSC color gamut, and 170-degree viewing angles. "That's mighty impressive," says DisplayBlog's Jin Jim. "Pixtronix will need to work closely with smartphone brands and OS providers to make sure color is accurate and doesn't needlessly pop. OLED displays have high color gamut, but the colors pop too much, leading to wholly inaccurate colors."

DisplaySearch says MEMS shutter technology will deliver better sunlight readability than AMOLED and any of the LCD technologies, but

inaccurate colors."

DisplaySearch says MEMS shutter technology will deliver better sunlight readability than AMOLED and any of the LCD technologies, but won't be superior to reflective MEMS or electrowetting in that regard.

REFLECTIVE MEMS

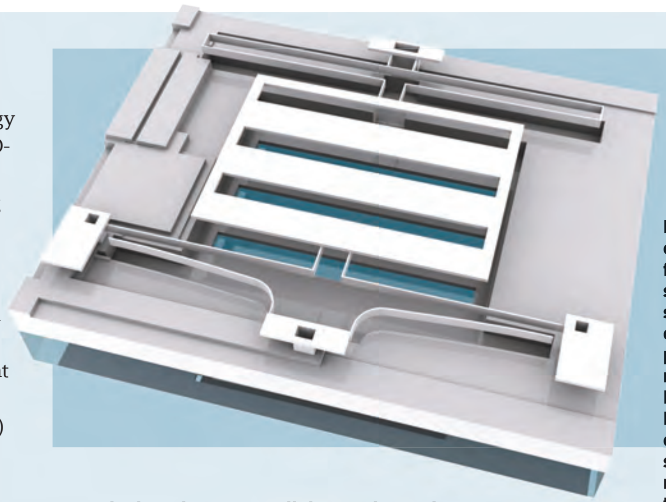
Reflective MEMS is a micro-electro-mechanical system like MEMS shutter, but it's an entirely reflective system that doesn't rely on a backlight unless you're using it in the dark. Qualcomm's Mirasol technology (www.mirasoldisplays.com) is the best current example of a reflective MEMS display.

Mirasol is based on the concept of interferometric modulation—the creation of color through the interference of reflected light. The display consists of many thousands of sub-pixels formed by extremely tiny (10 to 100 microns) iMOD elements, each with two conducting plates. One plate is a thin-film stack on a glass substrate, and the other is a mirror-like membrane suspended over the substrate with an air gap in between.

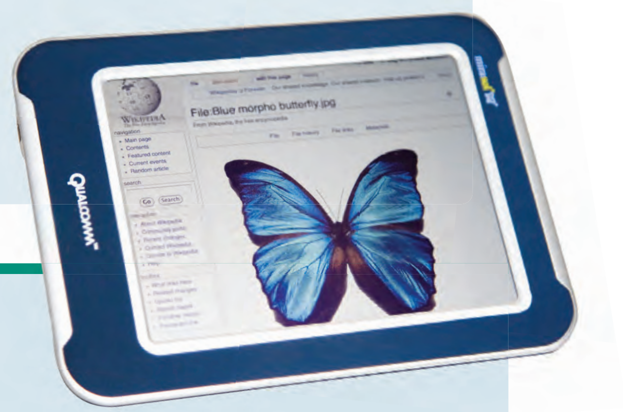
In the absence of voltage, the two plates are separated and ambient light is reflected off the sub-pixel. When voltage is applied, the two plates are drawn together and ambient light is absorbed by the sub-pixel. The color of each sub-pixel is determined by the size of the gap between its two plates. Triads of sub-pixels—one each for red, green, and blue—form a single viewable pixel, and by precisely manipulating the air gaps between the different sub-pixels, colors are formed. For example, a black pixel is created when the gaps in all three sub-pixels are completely closed.

Mirasol displays are bi-stable, meaning their iMOD elements require very little power to maintain their current state—once a pixel is red, it will remain red. Unfortunately, current iterations of Mirasol have limited color depth—about 45,000 colors total, as opposed to the some 16 million in a desktop LCD.

"I think Mirasol will be best aligned with budget eReaders and mobile handsets—devices that require very low power consumption and are used outside more often than indoors," says DisplayBlog's Jin Kim. "Because its color really isn't as brilliant compared to LCDs or OLEDs, high-end multimedia tablets will probably not sport Mirasol."



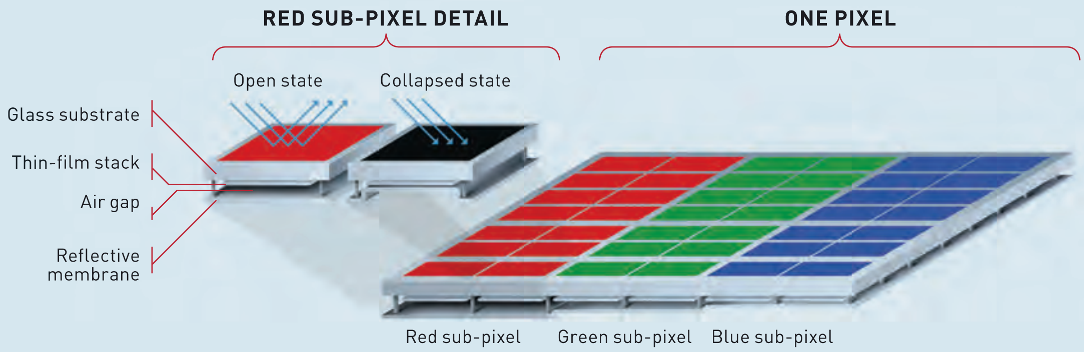
Behold: The mechanical assembly for a single MEMS shutter. Think a shutter the size of a pixel couldn't possibly operate reliably? Texas Instruments' DLP technology consists of pixel-size pivoting mirrors, and that technology has been around for years.



Qualcomm's Mirasol reflective MEMS technology should be rolling out in 5.7-inch ebook readers in 2011. Finally: Color electronic paper is almost here!

HOW IT WORKS

A Reflective MEMS Mirasol Display



By adjusting the air gaps of each red, green, and blue sub-pixel, a reflective MEMS Mirasol display can create about 45,000 different colors, according to Qualcomm.

WHITE PAPER

Botnets

How networks of computers linked by malware can wreak havoc, and what cybersecurity experts are doing about it –MOLLIE BRYANT

Since 2009, hundreds of centrifuges in Iran's nuclear facilities have been shut down because of "operational problems." The culprit? Stuxnet, a worm many suspect was created by Israel, that is capable of reprogramming industrial systems, and increasing electrical current frequency to converters, parts that control motors, and various machines in infrastructure control centers. Abrupt changes to nuclear centrifuges cause severe damage, making Stuxnet a bona fide cyber weapon.

Stuxnet is a particularly potent form of what's known as a botnet, a network of computers linked by a common infection, with the goal of compromising as many computers as possible. Botnets perform tasks from collecting private information to sabotaging networks. They are used to commit crimes like fraud, extortion, blackmail, spamming, phishing attacks, compromising user information or control settings, and committing DDoS attacks. But what makes botnets so successful, and how can we combat them?

BOT DEPLOYMENT

Although some bots spread via dropper programs that install malware, bot software usually contains spreaders that scan for software flaws known as zero-day vulnerabilities—software weaknesses for which a patch doesn't yet exist. These flaws can be found almost anywhere, such as Adobe products like Flash and Acrobat, or Microsoft's OS.

Botnet herders control infected computers, and in some cases, have wider control than the actual user. Some individuals and organizations engineer and manage their own botnets, but, like other malware, botnets can be bought, sold, and rented via Internet black markets. After creating and distributing a botnet, its manager can partition it into segments with different prices according to quality. Engineers also sell malware kits containing configurable software that creates a customized bot. Component kits, with infection mechanisms or exploit attacks, are also sold. Incredibly appealing commodities, malware kits can be configured without coding skills or experience, widening the range of people who can make use of botnets.

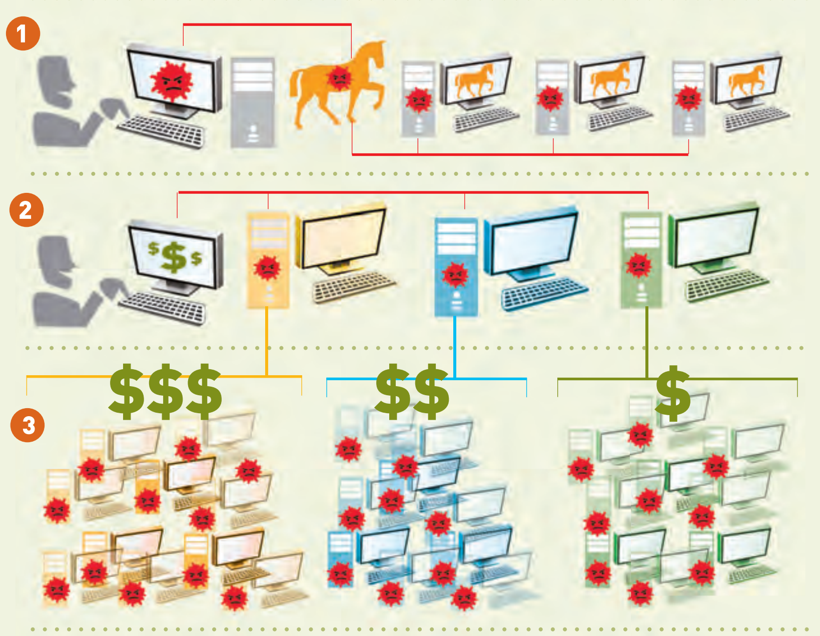
HERDERS AND C&C

After spreading as far as possible, a bot will contact its herder for further instructions. Although worms like Stuxnet run autonomously, without herder instruction, most bot software uses one of three protocols for herder-bot communication, aka Command and Control (C&C): Internet Relay Chat (IRC), HTTP, and Peer-to-Peer (P2P). With IRC, a bot logs into an IRC server for its herder's instructions, reporting back via chat. Bots can also save requested information into files that herders retrieve as desired. IRC drones, which have unusually high IRC traffic, first emerged in 1999 with a worm that collected private user information. In HTTP C&C, bots sign into a server under herder control that contains instructions. In one variation, herders use blogs or social networking sites like Twitter to leave coded messages with instructions for bots to find later. P2P networks facilitate communication between peers without the need for a central server, and herders take advantage of these nodal systems by using them to deliver infections or instructions directly to any computer connected to the network.

Herders work vigilantly to protect themselves and their work from being analyzed by

HOW IT WORKS

Botnet Development and Control



1) Original herder designs malware and distributes botnet. 2) The herder sends instructions to infected machines in order to capture even more computers in the botnet. 3) Herder divides botnets into segments based on quality and sells them to new herders who use the botnets for spam, phishing, DDoS attacks, etc.

cybersecurity (CS) or other hackers. Some malware evades detection by cutting off communication with antivirus software or preventing updates that patch software holes, and bots also take themselves off the radar by changing signatures and updating regularly. Botnets may frequently change networks as another way to avoid capture, and if they do get caught, bot behavior can be unpredictable. Bot software might not execute immediately or may not run at all, may delete portions of its software or detonate entirely, or it could run deceptive executions, performing tasks that mislead cybersecurity about their intentions. And with the implementation of packers that compress binary code, this tech can be very difficult to reverse engineer.

REDUCING THE BOTNET THREAT

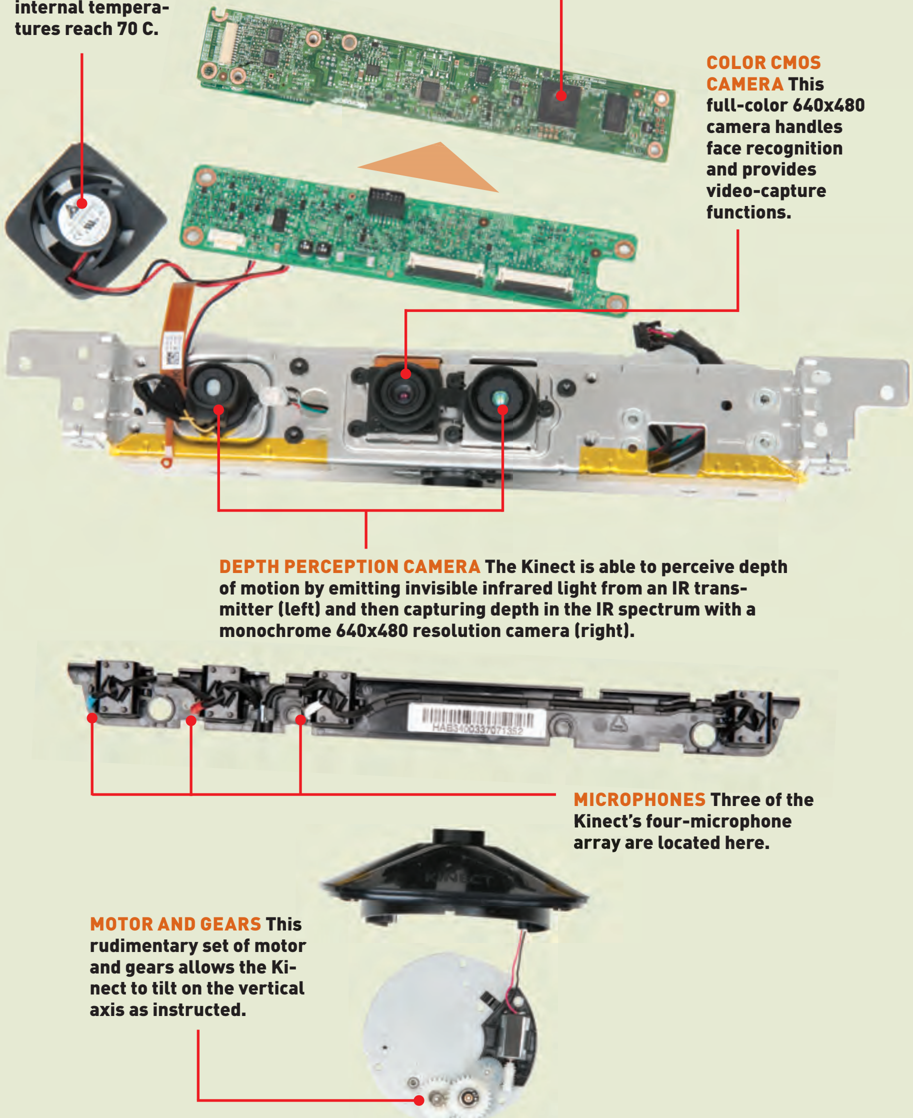
To capture bot software, CS teams establish server-side honeypots that lure malware with unprotected ports and other security weaknesses. To attract suspicious traffic, computer security sometimes places honeypots on server space called darknets, which are grids of unused IP addresses that should expect no traffic. Honeypots then collect malicious traffic entering this space. A variation on honeypots called "honeyclients" also collect malware, but they actively seek it out by emulating browsers. CS provides a list of URLs, and the honeyclient travels through the list, connecting to each URL and downloading any malware it finds.

CS also examines malware by running it inside isolated or virtual computers called "sandboxes." In this closed environment, CS teams interact with malware, reverse-engineering or otherwise analyzing it. CS agents can alter malware's surroundings to study its response. For example, the cybersecurity team studying the Conficker worm, with monetary damages estimated to be as high as $9.1 billion, moved their sandbox computer's time ahead. Initially, HTTP bots only connected to one source, but Conficker attempted to connect with many sites until finding its herder's. Running the worm ahead in time showed the "Conficker Cabal"—the generated list of IP addresses Conficker would be working from at any point in the future.

Botnets affect around 25 percent of computers worldwide, with the United States containing the most infections. Although malware can enter any network under the right circumstances, it helps to defend your computer with a firewall and antivirus software, and regularly patch your machine and its applications. Also, avoid suspicious websites, emails, or downloads that could install malware onto your computer. Although these precautions aren't foolproof, they will better protect your computer from becoming another drone in the botnet threat.

Microsoft Kinect

From a technological standpoint, Microsoft's much-ballyhooed Kinect is a modern marvel. The decision to eschew a physical controller in favor of an interface that uses faces, motion, and voice is way ahead of its time, but how does it work? We cracked one open to find out.



SUBMIT YOUR IDEA Ever wonder what the inside of a power supply looks like? Don't take a chance on destroying your own rig; instead, let us do the dirty work. Tell us what we should crack open for a future autopsy by writing to comments@maximumpc.com.

HOW TO

Step-by-Step Guides to Improving Your PC

THIS MONTH

64 STORE MULTIPLE BOOTABLE APPS OR OSes ON A SINGLE DISC

65 CONTROL YOUR MOUSE CURSOR USING THE KEYBOARD

66 SCHEDULE A SMART NIGHTLY SHUTDOWN

THREE GREAT WEBSITES FOR HOW-TO FANS

As much as we hate to admit it, it's impossible for us to cover *every* how-to topic imaginable. Therefore, here's a list of our three favorite online resources for the DIY crowd.



ALEX CASTLE
ONLINE MANAGING EDITOR

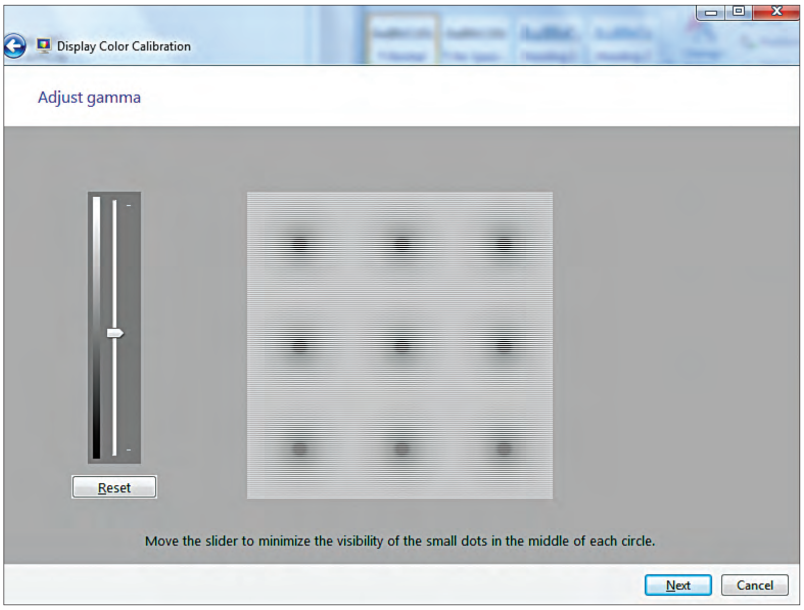
▶ **MakeUseOf.com** An excellent source of computer-related how-to guides and information, with a bent toward discovering new websites and services to make your life easier.

▶ **Instructables.com** No list of how-to sites would be complete without Instructables, which features a staggering array of well-documented how-to guides for inventive DIY projects.

▶ **YouTube.com** Even though you might associate YouTube more with the likes of "Bed Intruder" and "Double Rainbow" than with how-to guides, you won't find a better source for video tutorials online. When we need to figure out how to do something tricky, YouTube's our first (and usually last) stop.

SUBMIT YOUR IDEA Have a great idea for a How To project? Tell us about it by writing to comments@maximumpc.com.

WINDOWS TIP OF THE MONTH



Quickly Calibrate Your Monitor

In Windows 7 you can perform a quick-and-dirty calibration by opening the Run dialogue (hit Win + R) and typing DCCW to open the Display Color Calibration Wizard. It's not an in-depth treatment, but it only takes a minute and can make a big difference.

Store Multiple Bootable Applications or OSes on a Single Disc

As PC users, we're conditioned to think of software as something you run from within an operating system, and an operating system as a collection of files that you save to a hard drive, and then run at boot. However, you've probably run into some software that breaks this mold: "Live" operating systems, which can boot from a CD or USB drive, and applications that can be run directly from a CD, without the use of an OS. These can be some of the most useful tools at a hardcore computer user's disposal, but it can be hard to keep track of a bunch of different pieces of bootable media.

In this how-to, we're going to show you how to keep all of your bootable programs and operating systems on a single piece of media, using free software called XBoot. –ALEX CASTLE

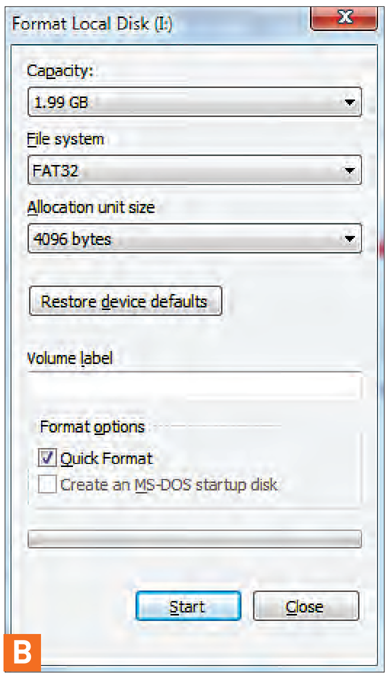
1 INSTALL XBOOT

XBoot installation is simple: Just head to the project homepage at http://bit.ly/fR7zcz and scroll to the bottom of the page to find the download link for the most recent version of the software. Download the .zip file, and extract the executable inside. Even though XBoot is a stand-alone executable file, and doesn't require installation, extract it to someplace you'll be able to find later (and don't just run it from within the zip archive) because later on it will create new files in its home directory.

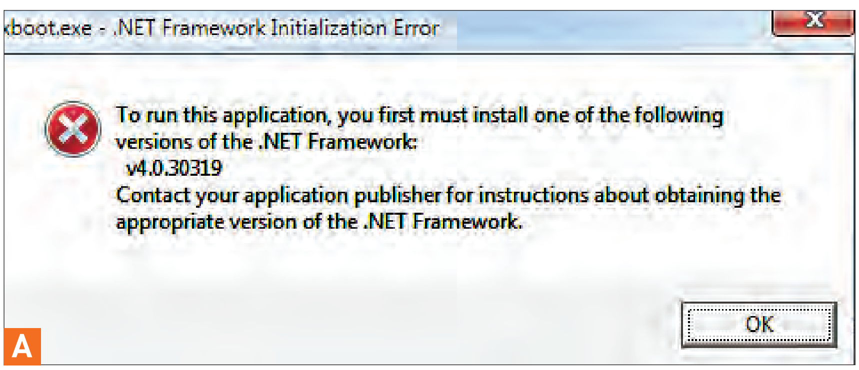
When you try to run the executable, you may be informed that you don't have the most recent version of the .NET framework (image A). Unlike a lot of software, XBoot is not packaged with the .NET installer, so you'll have to track it down yourself. Fortunately, the latest version of the framework can always be found for free at http://bit.ly/eVxEHT.

2 PREPARE YOUR DISC OR USB DRIVE

If you're going to be installing to an optical disc, you don't have to do much preparation—just make sure the computer you're going to be using is capable of booting from a DVD, if you're planning on using one (which you probably should be, since few Linux distros are small enough to fit more than one on a CD).



B



A

For a USB thumb drive, you'll want to start by backing up any files currently on it, then clearing the drive. Make sure you've got a drive big enough to hold whichever distros you want to run, then give it a quick format by right-clicking the drive and selecting Format from the context menu. This will help you make sure the drive's clear, and also that it's using the FAT32 file system, which is necessary for many Linux distros (image B).

3 CREATE YOUR MULTI-BOOT DISC

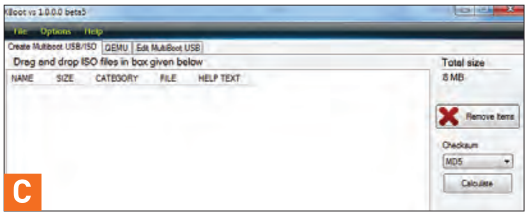
Now that you've got the latest version of .NET installed and your boot media ready to go, you can run XBoot. When you first start the program, you'll be greeted by a mostly blank window (image C). This is where you specify the programs and operating systems that you want to include on your disc or thumb drive. If you've already downloaded a program (in ISO form) you can simply drag and drop it onto this part of the window to add it to the list.

Unfortunately, only files on a list of supported files will work in XBoot, so if you try to drag a certain file onto the window but it tells you that it's not recognized, you're probably out of luck (image D). When this happens, the program will display a list of supported files, and you can find information about additional files that work using Grub4DOS ISO emulation at the XBoot project homepage.

If you would like to add an additional program supported by XBoot, but you don't already have the ISO file, click File > Download. This will open a window with the list of supported bootable files. Select one, then click the Open Download Page button, which will link you directly to the webpage where you can download the ISO file.

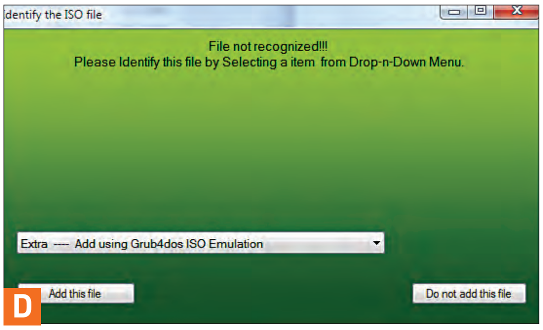
Once you've populated your list with every file you want to include, you're ready to create your disc. If you're planning to use a thumb drive you'll need to specify a bootloader to use, but the default (Syslinux) should work fine. If you're creating a bootable DVD, you're ready to go—just click Create ISO.

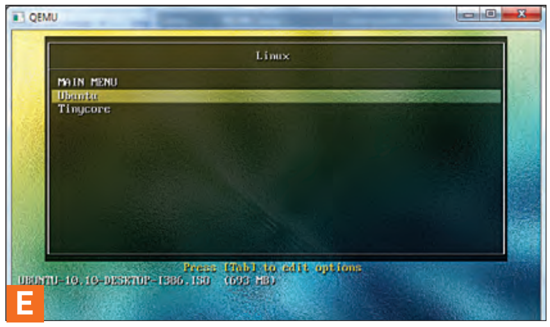
The program will spend some time



combining all the ISO files into a single bootable ISO. When it's complete, it will give you the option of booting your virtual boot disc in a virtualizer included with XBoot called QEMU (image E). If you want to try running an ISO file at any time in QEMU, you can access the emulator from the second tab at the top of the XBoot window.

If your ISO file works as expected in QEMU, you're ready to burn it to disc (using Windows 7's built-in ISO burner, or other software of your choice). XBoot names the ISO it creates "xboot.iso" and places it in the directory where the XBoot executable is located.





Control Your Mouse Cursor Using the Keyboard

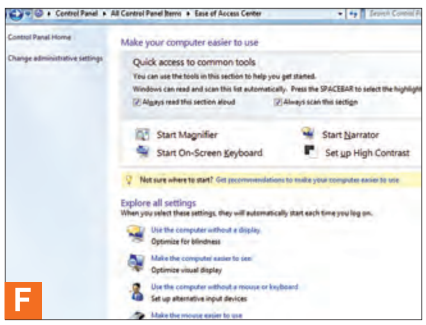
Most of Windows 7's accessibility options are, at best, of dubious usefulness to the average PC user. And that's fine, as they're generally designed for people with special needs, and can be easily deactivated. There's one accessibility option, however, that can be a big help to anyone: Mouse Keys.

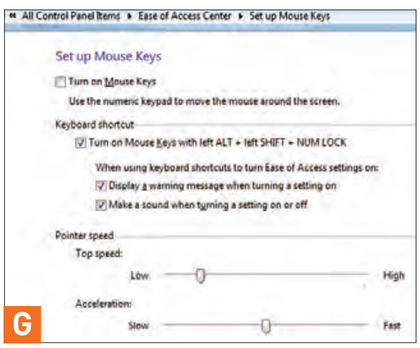
If the name didn't tip you off, Mouse Keys is an accessibility option that allows you to control the mouse cursor using your keyboard. This can be useful in two ways. First, there's an obvious utility to Mouse Keys if your mouse ever breaks, or if you have to disconnect it for any reason. Second, Mouse Keys is very precise—a single press of a key moves the cursor by one pixel, making it useful for any application that requires ultra-high precision, like Photoshop. –ALEX CASTLE

1 ENABLE KEYBOARD-DRIVEN MOUSING

First, open the Ease of Access Center panel from inside the control panel, then click the option marked "Make the mouse easier to use" (image F).

You'll see a checkbox labeled "Turn on Mouse Keys," and beneath it a link to "Set up Mouse Keys." Click the setup link,





where you'll find all the options for using Mouse Keys (image G). By default, the Mouse Keys hotkey is enabled, which is Alt + left Shift + Num Lock. Unless that happens to be your favorite keybind for WoW, just leave that enabled for quick access to Mouse Keys. There are two sensitivity settings—we recommend you max both of these out, because even then the Mouse Keys cursor moves painfully slow. To help that, we also recommend you check the box that makes the mouse move faster while the Control key is held down. With this setting, it's easy to get your cursor wherever you want it in a hurry.

2 CONTROL THE MOUSE

Once you apply your setting and click OK, you should be able to move your mouse around with the number keys and CTRL. You'll probably be confused at first as to how to click. It's a little complicated, but here's the breakdown:

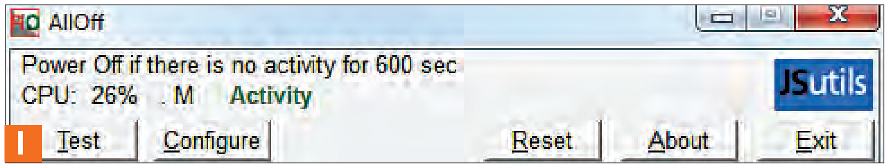
- To left click, press the 5 key.
- To double-click, press the plus key.
- To switch to right-click, press the minus key. Now 5 will right-click and plus will double right-click.
- To switch to simultaneous right- and left-click, press asterisk. This works the same way as the above.
- Finally, to switch back to left-clicking, press the slash key.

Schedule a Smart Nightly Shutdown

A lot of PC enthusiasts leave their computers on 24 hours a day, seven days a week. After all, you never know when you'll need to get a quick task done, and it's a pain to have to wait for your computer to wake up from sleep mode, or (worse!) to boot.

Still, a high-end PC can use a lot of electricity, and leaving yours on overnight can have a significant effect on your monthly energy bill. So, how can you get your computer to automatically shut down overnight, but not while you're using it?

We're going to show you how to use a free program called AllOff to do just that. –ALEX CASTLE



1 INSTALL ALLOFF

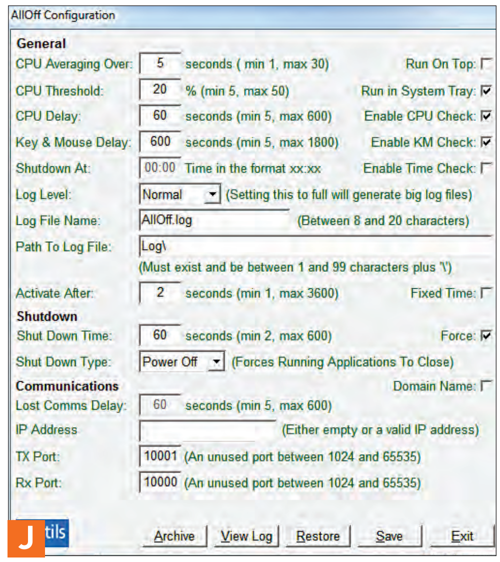
The AllOff installation's pretty much a no-brainer: Just download and run the installer from JSutils at http://bit.ly/grnvCR. The first time you run the program after installing it, you'll be asked for a registration code (image H). Don't panic—as long as you're using AllOff for personal use only, getting a registration key is free and automated. Just hit up the registration page at http://bit.ly/ghVfXU, and enter a name and a valid email address.



2 CUSTOMIZE ALLOFF

After registering AllOff, the program will disappear into your taskbar. When you double-click the AllOff icon in the taskbar, you'll see a very simple AllOff info pane (image I). Alarmingly, AllOff will be threatening to turn your computer off after 10 minutes of inactivity. Assuming you don't want that, click the Configure button.

The configuration menu is where you can customize AllOff to shut down your computer at exactly the right time. There's a daunting array of options to customize (image J), but here's what you should focus on:



Activate After This setting is the most important, since it allows us to make sure that our automatic shutdown only happens at night, after we've gone to sleep. By default the setting accepts a number of seconds to wait before the program activates, but if you click the Fixed Time checkbox you can enter a time of day. Enter 23:00 if you want to make sure that your computer doesn't shut down before 11:00 p.m.

Key & Mouse Delay This setting is probably the most basic—it is the amount of time (in seconds) that the computer has to receive no input before it's fair game to shut it down. The maximum value for this field is 30 minutes (or 1,800 seconds), which is probably a safe value if you want to make sure you're well and truly done using the PC before it can shut down.

CPU Averaging, Threshold, and Delay These are the options that allow us to make sure that AllOff doesn't turn off the computer while it's doing something important, like transcoding a video or downloading a file. The Averaging value can be left alone, but you'll have to set the Threshold based on the performance of your system. If you've got a machine that hums along, you can set this down low. On the other hand, if your machine idles at 30 percent or more CPU usage, you'll either have to bump up this setting or disable it altogether by unchecking Enable CPU Check. The CPU Delay box just defines how long the CPU has to be below the threshold before shutdown is enabled; you can probably leave this at a minute or two.

Shut Down Time, Type Finally, these two settings let you define how exactly the shutdown will work. The Shut Down Type drop-down box lets you choose what type of shutdown you want to do (shut down, hibernate, restart, etc.) and the Shut Down Time box lets you specify how much warning time your system gets before it's shut down. Unless you uncheck the Forced box, the shutdown will force any programs with unfinished business (unsaved documents, for instance) to shut down.

LENGTH OF TIME
2 HOURS

LEVEL OF DIFFICULTY
INTERMEDIATE

BUILD IT

A Sub-$1,000 Sandy Bridge Machine

You don't need to spend a fortune to take advantage of Intel's newest platform

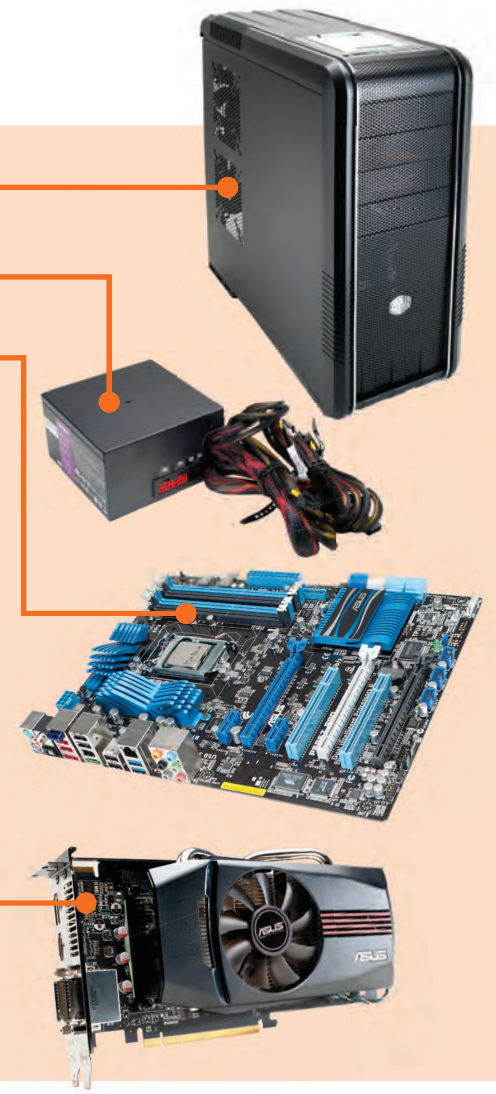


NATHAN EDWARDS
SENIOR ASSOCIATE EDITOR

THE MISSION Previous builds in this section have tended toward the expensive side, whether they've been the $8,600 photo studio (Holiday issue) or our $1,800 mini-ITX gaming build (December). While we stand by those choices (this is *Maximum PC*), we've also heard your cries for more affordable options. Often, a budget build means buying parts that are a little past their prime—and don't get us wrong, you can find great deals there. But for this month's build, I knew I wanted to explore Intel's hot new Sandy Bridge architecture—and, if I could swing it, one of AMD's new Radeon 6800 series GPUs—while keeping my total budget under $1,000.

INGREDIENTS

✔ **Case** Cooler Master 690 II Advanced www.coolermaster-usa.com	$80
✔ **PSU** Antec 750W True Power TP-750 www.antec.com	$110
✔ **Mobo** Asus P8P67 Pro www.asus.com	$184
✔ **GPU** Asus Radeon HD 6850 www.asus.com	$190
✔ **CPU** Intel Core i3-2100 @ 2.93GHz www.intel.com	$117
✔ **Cooler** Stock Intel www.intel.com	$0
✔ **RAM** Corsair 2 x 2GB DDR3/1333 www.corsair.com	$60
✔ **Optical** Lite-On iHAS424-98 DVD Burner us.liteonit.com/us/	$25
✔ **Drive** WD Caviar Black 1TB www.wdc.com	$90
✔ **OS** Windows 7 Home Premium, 64-bit OEM www.microsoft.com	$100
Total	**$956**



Choosing the Right Hardware

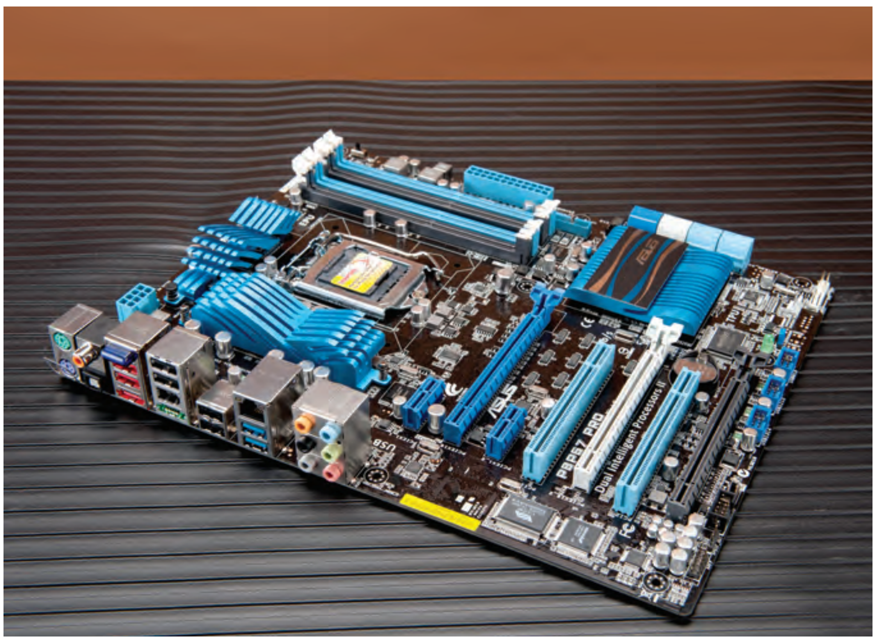
It's easy to build an expensive PC; it's much harder to build an inexpensive one. With a budgetary goal south of one grand, I had to make some hard choices to craft a hardworking machine that would still have plenty of life in it when upgrade time comes.

The most important consideration was the motherboard, of course, which I'll get to in a bit. For now, let's take a look at the other components. To stay within budget, I chose the entry-level Intel Core i3-2100 CPU, a 2.93GHz Sandy Bridge dual-core with Hyper-Threading. That should be plenty for most games. Since Intel has restricted overclocking to the higher-end parts, I don't need an aftermarket cooler—although if I had to pick one, I'd go for the $30 Cooler Master Hyper 212+. It's a lot of cooling for not a lot of dough. By the way, any aftermarket cooler that works on a Socket 1156 board will work on a Sandy Bridge board.

Since this is a gaming machine on a budget, I'm opting for a single hard drive, which will accommodate the OS (Win7 Home Premium 64-bit) and all my applications (including games) while offering plenty of storage and relatively high speeds. Western Digital's 1TB Caviar Black fits the bill while costing less than $100. I don't need a Blu-ray player at the moment, so I'm settling for an inexpensive Lite-On DVD burner, which will help during OS install. My PSU is Antec's semi-modular TruePower TP-750, which at 750W has more than enough juice for all my components.

I asked *Maximum PC* videocard guru Loyd Case about the best card for my budget, and he advised using either the overclocked Gigabyte GTX 460 reviewed in November 2010 or the cheaper and more powerful Asus Radeon HD 6850. Well, I'm all about more power, and the fact that the Asus 6850 requires only one 6-pin power cable didn't hurt. A 2 x 2GB kit of Corsair DDR3/1333 lets me take advantage of my motherboard's dual memory channels, with plenty of space to upgrade later.

I love a classy chassis. I'm incredibly resistant to throwing good parts into a boring box, so I cringe at the sub-$50 set. Fortunately, I can have my cake and save money too with the Cooler Master CM 690 II Advanced, which retails for $70 and includes such niceties as a top SATA dock, a fully painted interior, and three fans—with room for plenty of aftermarket additions.



The Asus P8P67 Pro is packed with ports, from six USB 2.0 ports to two USB 3.0 ports, two eSATA ports, S/PDIF, optical-out, onboard surround sound, and more.

NEVER BUILT A PC BEFORE?

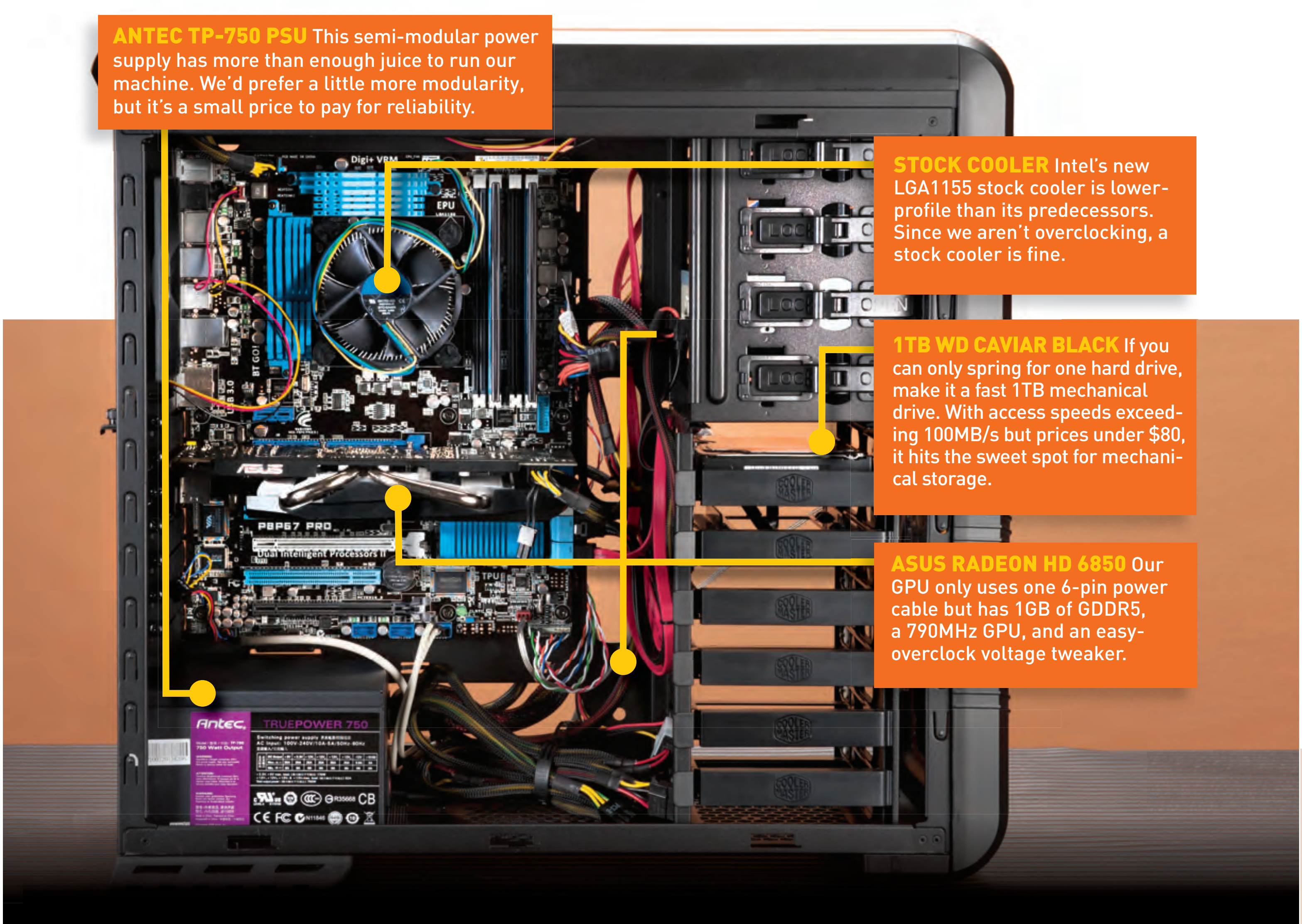
Your case, motherboard, and cooler all come with useful instructions, but be sure to check out our most recent step-by-step guide at http://bit.ly/bldcreed.

THE MOTHERBOARD

The most important part of the sub-$1K gaming machine is the motherboard. Asus's P8P67 Pro is based on one of the four new Sandy Bridge chipsets: the P67. The P67 chipset, unlike the Q67 and H67, doesn't support the onboard graphics core of the new Sandy Bridge chips, but c'mon. I'm building a gaming rig. Onboard graphics ain't gonna cut it. The P67 does support overclocking, though. And although my Core i3-2100 doesn't support overclocking (that's one downside of Sandy Bridge), the top-tier "K" parts do, and I can get a quad-core Core i5-2500K for just $215. So, if or when I want to upgrade down the line, my mobo is ready to rock.

The P8P67 Pro also includes four SATA 3Gb/s ports and four 6Gb/s ports (two onboard, two run on a Marvell chip). It has two back-panel USB 3.0 ports and an internal header and expansion card that allow me to add two more. Not to mention six USB 2.0 ports, two eSATA ports, and Bluetooth. Oh, and UEFI, so if I want to bump up that 1TB drive to 3TB, I can.

The Inner Sanctum



TIME IS MONEY

Wiring Is Free

A budget build doesn't have to look cheap. One of the easiest ways to make your PC look snazzy is to take a few extra minutes while building to route the wires in an attractive way. The ease of cable management depends greatly on two factors: your case and your PSU. A modular PSU allows you to remove power cables you aren't using (reducing case clutter), while many cases offer cable-management amenities ranging from routing holes to zip-tie tie-down points to spacious side panels.

The Cooler Master CM 690 II Advanced offers all three—there are cutouts in the motherboard tray to route front-panel headers, SATA cables, and ATX power cables, plus tie-downs to secure the cables to, as well as space behind the motherboard tray to accommodate all those cables. While it's not as feature-packed as more expensive cases (we'd have liked to see rubber grommets on the routing cutouts, for example), the CM 690 II allows for some decent wiring jobs. Using a more modular PSU would enable me to further cut down on the clutter, as unused cables could simply be removed from the chassis.

Crunching the Numbers

Here at *Maximum PC*, we have a different definition of "budget" than do most people. While 90 percent of the market doesn't need to do anything more advanced than surf the web and play FarmVille, our needs are a little bigger. For us, a budget PC still needs to be able to play the latest games at high resolutions and accomplish general computing tasks with aplomb. It also needs to be upgradable (which is to say, not immediately obsolete upon construction/purchase), and, well, fun. That's why our "budget" rig still costs close to $1,000—and that's without monitor, speakers, keyboard, and mouse.

OK, here's the upside. By challenging myself to use Intel's new Sandy Bridge platform and the latest Radeon graphics platform, I've ensured that my system can take advantage of today's latest tech—USB 3.0, SATA 6Gb/s, DirectX 11, Eyefinity, UEFI—while still having considerable room to grow. I won't say "future-proof" because there's no such thing. But using the brand-new P67 chipset, I've made sure that when the time comes for a CPU upgrade, I can switch to one of Intel's overclockable "K" parts, making a CPU upgrade not only feasible but desirable. I can easily add 4GB more RAM, upgrade my videocard, move my OS to a solid-state drive, or add 6Gb/s SATA drives down the line.

All those upgrades, however, cost money. In order to squeak in under the $1K barrier, I've had to make some sacrifices today, and those sacrifices show up in my rig's benchmark performance.

REALITY CHECK

To my dismay—if not surprise—my budget rig couldn't even get within swinging distance of our zero-point rig. Most of the blame lies with the CPU. While Sandy Bridge CPUs perform, on average, 10 percent faster clock-for-clock than the Nehalem Core-i7 chips in our zero-point and the Builder's Creed rig we built in November, those CPUs have the advantage of more cores and higher clock speeds.

Now, it's not really fair to expect a $1,000 machine to be as fast as a $1,600 or $2,500 machine, and it's important to remember that our benchmarks are designed to punish the fastest gaming rigs on the planet. But by putting a dual-core chip with no overclocking up against a pair of overclocked quad-cores, I've brought a knife to a gunfight. An affordable, fancy, shiny, upgradeable knife, possibly made of Damascus steel. But still: not a gun.

In our multithreaded Sony Vegas Pro 9 benchmark, our budget build, with half the cores of our zero-point, did half as well. In the single-threaded Lightroom 2.6, on the other hand, the budget build was only 16 percent slower—evidence of Sandy Bridge's clock-on-clock improvements.

Our MainConcept Reference and ProShow tests also taxed our budget build, where we found scores 35 percent and 46 percent slower than our zero-point rig's.

In our Stalker: Call of Pripyat and Far Cry 2 benchmarks, which run at 2560x1600, the budget build pulled down 18.4fps and 65.4fps—barely playable in Stalker's case but fine in Far Cry 2. Dropping the resolution to 1920x1080 bumps the Stalker score back up to playable territory.

Our budget rig's performance, aside from Lightroom, was between 35 percent and 56 percent slower than our zero-point's. Considering that it costs less than half what our zero-point would cost even today, we're calling that a win.

SANDY BRIDGE VS. ZERO-POINT

	ZERO-POINT	
Vegas Pro 9 (sec)	3,049	6,064 (-50%)
Lightroom 2.6 (sec)	356	426 (-16%)
ProShow 4 (sec)	1,112	1,711 (-35%)
Reference 1.6 (sec)	2,113	3,906 (-46%)
STALKER: CoP (fps)	42	18.4 (-56%)
Far Cry 2 (fps)	114.4	65.4 (-43%)

0 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Our current desktop test bed consists of a quad-core 2.66GHz Core i7-920 overclocked to 3.5GHz, 6GB of Corsair DDR3/1333 overclocked to 1750MHz, on a Gigabyte X58 motherboard. We are running an ATI Radeon HD 5970 graphics card, a 160GB Intel X25-M SSD, and 64-bit Windows 7 Ultimate.

SANDY BRIDGE VS. BUILDER'S CREED

	BUILDER'S CREED	
Vegas Pro 9 (sec)	3,660	6,064 (-40%)
Lightroom 2.6 (sec)	253	426 (-41%)
ProShow 4 (sec)	1,071	1,711 (-37%)
Reference 1.6 (sec)	2,250	2,703 (-42%)
STALKER: CoP (fps)	27.9	23.5 (-34%)
Far Cry 2 (fps)	72.6	64.4 (-10%)

0 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Our Builder's Creed rig consists of a quad-core 2.8GHz Core i5-760 overclocked to 4GHz, 4GB of Corsair DDR3/1333, on an Asus P7P55D-E Pro motherboard. We are running an Asus ENGTX 470 GPU, a 60GB Corsair Force F60 SSD, and 64-bit Windows 7 Home Premium.

The Last Word

In the end, I did what I set out to do: craft a rig that can play all the latest games, with the latest tech—Sandy Bridge, a current-gen GPU, USB 3.0, SATA 6Gb/s—for under $1,000. I had to make some compromises, but the end result is still a respectable performer. If I could spend an extra $100, I'd swap the 2.93GHz dual-core Core i3-2100 for a $216 3.33GHz quad-core Core i5-2500K. That would give us two extra physical cores (although the same number of virtual cores, as the 2500K lacks Hyper-Threading), as well as the ability to overclock. And the resulting performance would be much closer to our zero-point system. Grand total for that machine? $1,057. Add $30 for an aftermarket Cooler Master Hyper 212+ CPU cooler to help with the overclocks, and you'd still be south of $1,100. Add a solid-state drive and a more powerful GPU, and we're talking closer to $1,600.

The truth is that you don't need to spend a fortune to get a great gaming PC—but it helps.



We did it: A brand-new, sub-$1,000 Sandy Bridge machine that performs well and is ready to upgrade whenever you are. And it doesn't look half-bad, either.

SUMBIT YOUR IDEA Have an awesome idea for Build It? Let us know at comments@maximumpc.com.

REVIEWS

Tested. Reviewed. Verdictized.



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iBuypower Paladin XLC

Hexa-core's white knight?

Ever since the appearance of Intel's smoking-fast second-gen Core i7 processor in January, we've been wondering if Intel's hexa-cores still have a purpose. When iBuypower's Paladin XLC strode into town with a hearty Intel six-core inside its shining white armor, we expected an epic battle.

And we got one. Outfitted with Intel's priciest hexa-core, the 3.33GHz Core i7-980X, the Paladin XLC seemed destined to take on Falcon Northwest's black-clad Mach V system that we reviewed in February.

Using NZXT's excellent Phantom case, the Paladin XLC certainly strikes an impressive pose. Along with 12GB of DDR3/1600, a 128GB A-Data SSD, a 2TB hard drive, and a 10x Blu-ray burner, the Paladin XLC fields an imposing collection of hardware, and at a decent price.

But that's the rub. Though stuffed with a hexa-core, the Paladin XLC is outfitted with a pair of solid, but let's face it, budget AMD Radeon HD 6870 cards. We weren't surprised because that jibes with iBuypower's reputation of providing a crapload of hardware at a hell of a good price. Getting a water-cooled, CrossFireX hexa-core machine at $3,500 is a pretty good deal.

Unfortunately for the Paladin XLC, it's not enough to take out its closest competitor: the Falcon Northwest Mach V. Yes, it's a bit of a mismatch here. The Mach V is about $800 pricier, which gets you a crazy OCZ Revo X2 drive and a pair of GeForce 580 GTX cards. With the GeForce 580 GTX crowned as the new king, we didn't expect much of a competition in graphics and we didn't get one. In our STALKER: CoP benchmark at super-high resolutions, the pair of GTX 580 cards can match the performance of tri-SLI GTX 480 cards. The pair of Radeon HD 6870 cards, on the other hand, is about the equivalent of a single Radeon HD 5970 card. In Far Cry 2, which is less dependent on the GPU and more dependent on CPU, the competition gets closer. The Paladin XLC pushes out a very respectable 147fps. That far outstrips our zero-point's HD 5970 and overclocked quad-core combo, but again, the two GeForce GTX 580s are far more impressive. OK, so GPUs that cost twice as much are faster. What about CPU-based benchmarks?

That's where it gets interesting. The Paladin XLC against our zero-point is an easy win. The six cores beat our four cores quite handily. But against the higher-clocked Sandy Bridge CPU, it's far closer than we expected it to be. The Sandy Bridge–based Mach V is actually slightly faster in Lightroom and ProShow Producer. The six-core fires back, though, by beating the Mach V in Sony Vegas Pro 9 and MainConcept Reference.

So, what can we determine from all this? There is still value in hexa-core chips. Perhaps not the advantage they had just two months ago, but in anything that's heavily multi-threaded, six cores can still prevail. Even with the Mach V clocked up 500MHz faster than the Paladin XLC, the hexa-core still has moxie.

And that's really what the Paladin XLC represents. It's a pretty good bargain when you consider the hardware loadout. The similarly outfitted Velocity Micro Edge Z55 system that we reviewed in our December issue tipped the scales at $4,300. iBuypower shaves $800 off of that and gives you faster graphics cards than that system, too.

So, while the iBuypower cannot defeat the black knight, it fights the good fight. And isn't that all any Paladin would care about?

—GORDON MAH UNG



White is the new black, which was the new beige.

SPECIFICATIONS

Processor	Intel 3.33GHz Core i7-980X overclocked to 4.2GHz
Mobo	Asus Rampage III Extreme
RAM	12GB DDR3/1633
Videocard	Two Radeon HD 6870 in CrossFireX
Soundcard	Onboard
Storage	128GB A-Data SSD, 2TB Hitachi 7,200rpm
Optical	LG 10x Blu-ray burner (WH10L530)
Case/PSU	NZXT Phantom

BENCHMARKS

	ZERO POINT	
Vegas Pro 9 (sec)	3,049	2,209
Lightroom 2.6 (sec)	356	287
ProShow 4 (sec)	1,112	918
Reference 1.6 (sec)	2,113	1,543
STALKER: CoP (fps)	42.0	43
Far Cry 2 (fps)	114.4	147.7

0 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Our current desktop test bed consists of a quad-core 2.66GHz Core i7-920 overclocked to 3.5GHz, 6GB of Corsair DDR3/1333 overclocked to 1750MHz, on a Gigabyte X58 motherboard. We are running an ATI Radeon HD 5970 graphics card, a 160GB Intel X25-M SSD, and the 64-bit version of Windows 7 Ultimate.

VERDICT 8

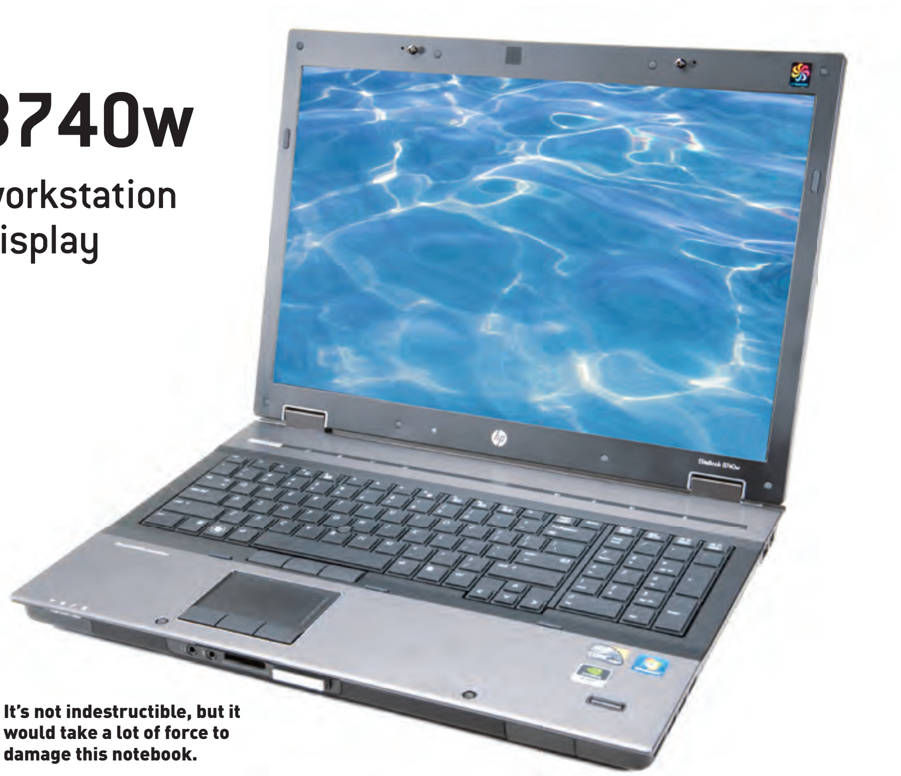
IBUYPOWER PALADIN XLC

+ PALADIN	− ILLUSIONIST
Six cores and CrossFireX for $3,500.	Mismatch between budget GPU and extreme CPU.

$3,500, www.ibuypower.com

HP EliteBook 8740w

A sturdy, high-end mobile workstation with a professional-grade display



It's not indestructible, but it would take a lot of force to damage this notebook.

It's difficult to pick just one standout feature of the HP EliteBook 8740w mobile workstation. Certainly a bright, 17-inch, 10-bit LCD panel that's capable of displaying more than 1 billion colors and remains visible at up to about a 170-degree offset without any color degradation is worth noting. But so is the notebook's durable design, with its spill-resistant keyboard, magnesium-alloy chassis, and magnesium-aluminum display enclosure. Then there's also the 8740w's impressive performance that runs circles around our zero-point configuration.

With features squarely aimed at businesses that require a color-accurate display, such as graphic-arts production and medical imaging—as well as less-than-forgiving work environments, such as a factory floor—there is little doubt why the 8740w is considered a mobile workstation. This also goes a long way toward explaining a price tag that starts at $3,000. Powered by a 2GHz Intel Core i7-920XM processor, with 8GB of 1,333MHz DDR3 SDRAM, a 320GB 7,200rpm hard drive, and an Nvidia Quadro 5000M GPU with 2GB of GDDR5 memory, our eval unit cost a hefty $5,290.

Speaking of hefty, our unit weighed a not-inconsequential 8 pounds, 6.4 ounces—add to that another 2 pounds, 2 ounces for the chunky power brick. Much of the weight can be attributed to the notebook's sturdy build, which reportedly meets mil-spec standards.

While you probably won't be using the 8740w inside an M1 Abrams tank, you can be assured that the 8740w's performance is equivalent to the M1 Abrams's firepower. Take for instance the 8740w's showing in our multi-threaded content-creation tests: The 8740w was 69 percent speedier than the zero-point iBuypower M865TU in Adobe Premiere Pro CS3, and 80 percent faster in ProShow Producer. Before you declare mission accomplished, however, we should point out that the hexa-core 3.33GHz Core i7-980X–based Eurocom D900F we reviewed in June 2010 lands an uncontested coup against the 8740w—including a 225 percent trouncing of the 8740w in our Premiere Pro test.

When you're not busy designing Bradley Fighting Vehicles and instead want to use one to blow things up—virtually, of course—the 8740w provides decent gaming chops. A frame rate of 49.6fps in Far Cry 2 is noticeably swifter than the 34.8fps we saw with the D900F, although the 8740w's 71.5fps in Call of Duty 4 is just a hair ahead of the D900F's 73.2fps.

Of course, the Nvidia Quadro 5000M—a high-end Fermi GPU with 320 CUDA cores and a memory bandwidth of 76.8GB/s—does much more than just play games. To test the 8740w's capabilities as a graphics workstation, we ran the SpecViewperf11 OpenGL-based workstation benchmark on the notebook. While the 8740w made an impressive showing on SpecViewperf11's individual tests, its overall performance didn't quite measure up to what you could expect from even a relatively less-expensive desktop workstation.

The 8740w would be an awfully expensive notebook to bring to a LAN party—but you could and you'd be glad you did. Where it'll be more at home, however, is in the hands of a professional designer, architect, or technician who needs the high level of color accuracy of its display. Just make sure the purchase doesn't overdraw your checking account and be sure to eat your Wheaties before you pick it up and start carting it around. –DANIEL A. BEGUN

SPECIFICATIONS

CPU	2.0GHz Core i7-920XM
RAM	8GB DDR3/1333MHz
Chipset	Intel QM57
Hard Drive	320GB WDC Western Digital WD3200BEKT-60KA9T0 (7,200rpm)
Optical	HP CDDVDW TS-L633N
GPU	Nvidia Quadro 5000M
Connectivity	VGA, DisplayPort, Ethernet, 56K V.90 modem, two USB 3.0, two USB 2.0, eSATA, FireWire, ExpressCard/54 slot, smart-card reader, mic in, 6-in-1 media reader, Bluetooth, 802.11a/b/g/n, fingerprint sensor
Lap/Carry	8 lbs, 6.4 oz / 10 lbs, 8.4 oz

BENCHMARKS

	ZERO POINT	HP EliteBook 8740w
Premiere Pro CS3 (sec)	1,320	780
Photoshop CS3 (sec)	153	119
ProShow Producer (sec)	1,524	846
MainConcept (sec)	2,695	1,651
Far Cry (fps)	32.7	49.6
Call of Duty 4 (fps)	58.2	71.5
Battery Life (min)	100	64 (-36%)

0 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Our zero point notebook is an iBuypower M865TU with a 3.06GHz Core 2 Duo T9900, 4GB DDR3/1066, a 500GB Seagate hard drive, a GeForce GTX 260M, and Windows 7 Professional 64-bit. Far Cry 2 tested at 1680x1050 with 4x AA; Call of Duty tested at 1680x1050 with 4x AA and 4x anisotropic filtering.

VERDICT 8

HP ELITEBOOK 8740W

+ RAILGUN	– NAIL GUN
Professional-caliber display; sturdy build; great performance.	Very expensive; heavy; poor battery life; middling SpecViewperf11.

$5,290, www.hp.com

AsRock Vision 3D 137B Home-Theater PC

A killer Blu-ray 3D player—and so much more

Home-theater PCs don't generate much interest among mainstream consumers. That's a bit mind-boggling, considering how many features these machines offer and the fact that most people are already familiar with the Windows interface. But luckily for us enthusiasts, companies like AsRock keep working diligently to improve HTPC design. The Vision 3D delivers nearly every digital entertainment feature you could want, including Blu-ray 3D, Internet TV, video on demand, online music services, and access to all the digital media stored on your own network.

The machine's $850 street price renders it very expensive compared to, say, a media-streamer like the Boxee Box, especially since it doesn't come with everything you'll need to get started (more on that in a moment). On the plus side, however, TV networks and service providers such as Hulu can't block an HTPC from accessing their content online.

You'll find no operating system, keyboard, or mouse bundled with the Vision 3D—and this isn't necessarily bad, because you won't be paying for items you don't need or want. The machine does come with an infrared Windows Media Center–style remote control, however, as well as the OEM version of Cyberlink's PowerDVD 10. When pricing the machine, don't forget to factor in the cost of whatever OS and controllers you decide to use. And if you want to watch Blu-ray 3D movies, you'll want Nvidia's 3D Vision kit ($200, with extra glasses costing $150 each). The review unit we received had Windows 7 Ultimate installed. We used a generic wired keyboard and mouse to run benchmarks, and Nvidia's shutter glasses for 3D movies.

AsRock opted to use components more typically found in notebook PCs. This helped it build an HTPC that will fit just about anywhere. More importantly, the Vision 3D doesn't require a lot of noisy fans for cooling. There's an Intel 2.4GHz Core i3-370M mobile CPU, and a 500GB Western Digital Scorpio Black hard drive. If that's not enough storage for you, you can add external drives using the machine's eSATA, USB 2.0, or USB 3.0 ports.

Nvidia's GeForce GT 425M graphics processor, coupled with 1GB of DDR3 memory, enables the machine to decode Blu-ray 3D movies and stream both video and high-definition soundtracks (Dolby TrueHD and DTS-HD Master Audio) over a single HDMI 1.4a cable to your A/V receiver. That feature alone makes the Vision 3D unique among prefab home-theater PCs. With its Core i3 and discrete GeForce card, the Vision 3D is easily the most powerful mini HTPC we've tested and far outstrips those based on Atom processors.

The only feature missing from this machine is a TV tuner. You could add a USB device to grab over-the-air programming, but this HTPC will never replace your cable company's set-top box or DVR. That's about the only criticism we can level at this rig. It delivered excellent image quality in Blu-ray movies, it's capable of streaming HD audio over HDMI, and it supports HDMI 1.4a for Blu-ray 3D. It's better than any Blu-ray player or media streamer on the market. Heck, it's the best home-theater PC we've tested. **–MICHAEL BROWN**

MAXIMUMPC KICK ASS!

VERDICT 9

ASROCK VISION 3D HTPC

+ GOLDEN EARS	**– TIN EARS**
HD audio bitstream over HDMI; attractive industrial design; powerful, yet extremely quiet.	Expensive; no TV tuner; exposed ports on front panel.

$850 (street), www.asrock.com

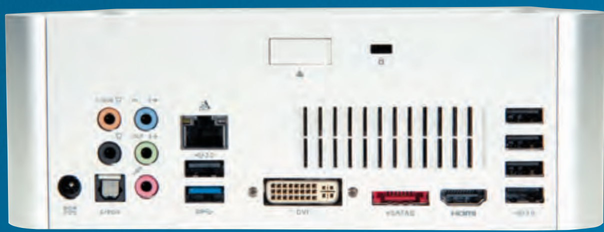
BENCHMARKS

	ZERO POINT	
Photoshop CS3 (sec)	449	162 (+177%)
MainConcept (sec)	7,080	2,452 (+189%)
3DMark03	2,540	17,394 (+585%)
Quake 3 (fps)	192	112 (-42%)
Quake 4	28.6	537 (+1778%)

0 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Our zero-point is a Dell Inspiron Zino HD equipped with a dual-core 1.5GHz Athlon X2 3250e, 2GB of DDR2/667, an AMD 780G with integrated Radeon HD 3200, a 250GB 7,200rpm Western Digital hard drive, and 64-bit Windows 7 Home Premium.





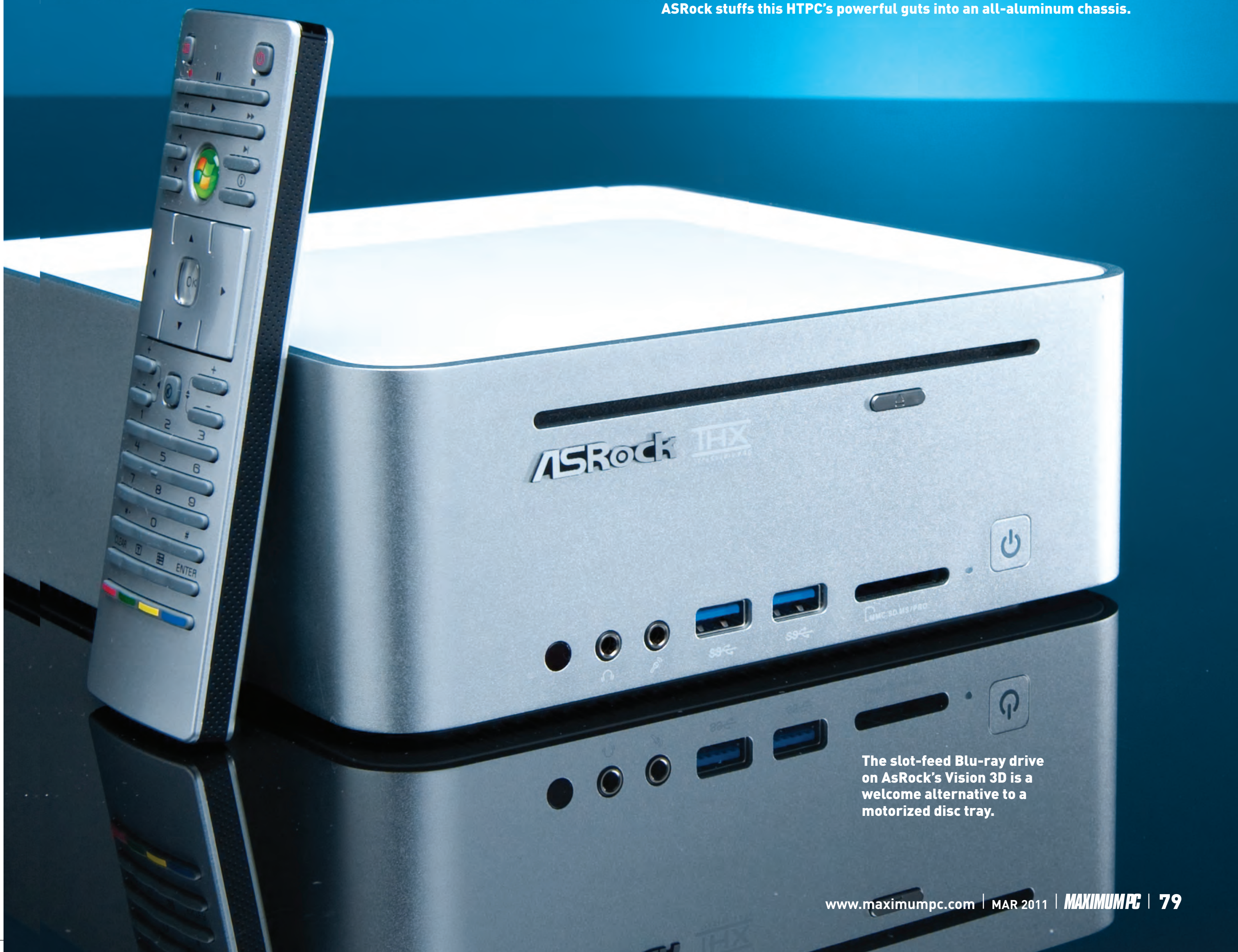
Should you decide to expand the ASRock Vision 3D's storage capabilities, the two USB 3.0 ports and single eSATA port will come in handy.



ASRock stuffs this HTPC's powerful guts into an all-aluminum chassis.

SPECIFICATIONS

Processor	Intel 2.4GHz Core i3-370M
Mobo	AsRock HM55-MXM
RAM	4GB Kingston DDR3/667
Videocard	Nvidia GeForce GT 425M
Soundcard	Onboard
Storage	500GB Western Digital Scorpio Black, 7,200rpm drive
Optical	Slimtype BD E DL4ETS Blu-ray player/DVD burner
Case/PSU	Custom/90-watt external brick

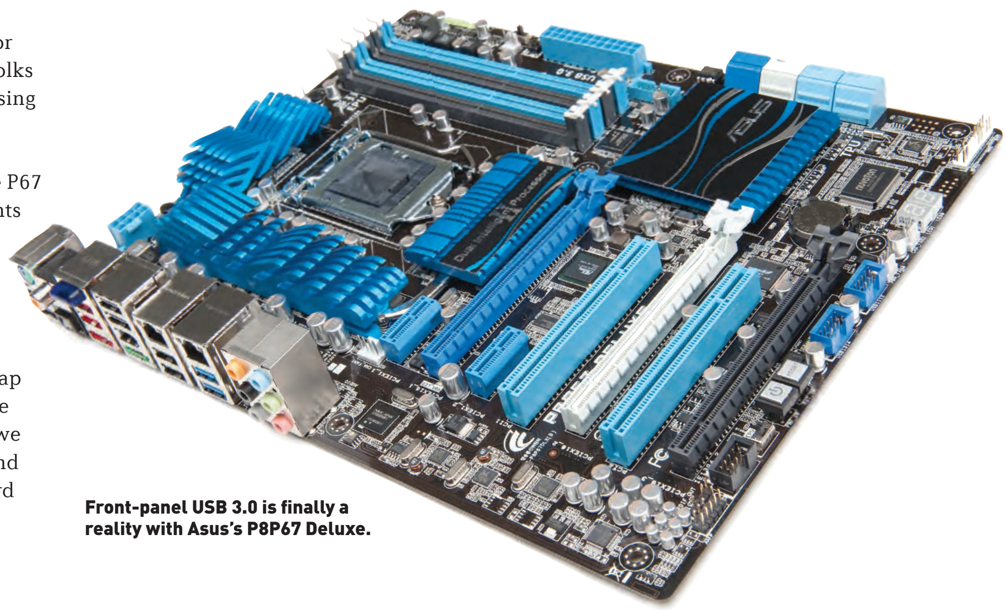


The slot-feed Blu-ray drive on AsRock's Vision 3D is a welcome alternative to a motorized disc tray.

Motherboard Mano-a-Mano

The brave new world of LGA1155

There's good news and bad news for Intel lovers. The bad news is for folks who just bought a motherboard using the LGA1156 socket: Yup, it's obsolete already. The good news: The LGA1155 motherboards using Intel's performance P67 chipset are swimming with improvements such as native SATA 6Gb/s support, front-panel USB 3.0 headers, and UEFI. The biggest change, of course, is support for Intel's new line of Sandy Bridge CPUs. These second-generation Core ix processors are not only fast, they're cheap and overclock like hell. To find a suitable home for your new Sandy Bridge chip, we gathered up boards from old foes MSI and Asus to see whose next-gen motherboard deserves the honor. –GORDON MAH UNG



Front-panel USB 3.0 is finally a reality with Asus's P8P67 Deluxe.

ASUS P8P67 DELUXE

We'll be honest: We've had the most hands-on time with Asus's new P8P67 Deluxe board of any P67-based board this cycle. That's because Asus sent a functioning board to us far before its competitors (including Intel) did, and as such, we conducted the bulk of our Sandy Bridge chip testing with the P8P67 Deluxe board.

Usually, early boards mean soldered-on wires, unpredictable performance, and hiccups that are often a consequence of very early hardware. None of that was true of the P8P67 Deluxe board. Out of the box, it offered rock-solid stability and its performance was excellent across the board.

POST the P8P67 Deluxe and you'll notice the first big change: Universal Extendible Firmware Interface, or UEFI. The arrival of UEFI on the PC might feel like that long-awaited unicorn bar mitzvah, but it's actually been around for some time. Numerous Intel boards have had UEFI but you'd never know it from looking at their BIOS-like interface.

You won't get that feeling from the P8P67 Deluxe board, and any misgivings you have regarding the change to UEFI will likely vanish when you see the beautiful interface Asus has developed. The configuration screen alone will remind you how ancient that 16-bit BIOS is. Navigating the UEFI isn't as intuitive if you're used to moving about a BIOS, but it's a brave new world we like.

On the hardware front, Asus packs a lot into this $240 motherboard. With Intel finally releasing a spec for a USB 3.0 internal header, Asus takes advantage by including a 3.5-inch drive-bay adapter with two USB 3.0 ports to boot. Why is this needed? Previously, case enclosures that included front USB 3.0 required you to run cables out of the back of the case and plug into the rear USB 3.0 ports. This eats up your USB 3.0 ports and is inelegant, to say the least. The Deluxe board gives you two front USB 3.0 ports, plus the two on the rear.

The USB 3.0 isn't native to the P67 chipset, but the SATA 6Gb/s is. Sort of. Intel finally adds SATA 6Gb/s but only two of the ports in the P67's peripheral controller hub have it. Why? To save money. Intel says running more than two ports would add additional pin-outs to the PCH and, well, that costs dinero. The result is a horrific headache of port confusion. On feature-rich boards like the P8P67 Deluxe, this gives you four SATA 3Gb/s ports plus two SATA 6Gb/s off of the Intel PCH. Add another two SATA 6Gb/s from the Marvell 9128 controller and your SATA mode will greatly depend on which port you luck yourself into. You'll definitely want to run the Intel SATA 6Gb/s over the Marvell because it's faster, but you have to RTFM first.

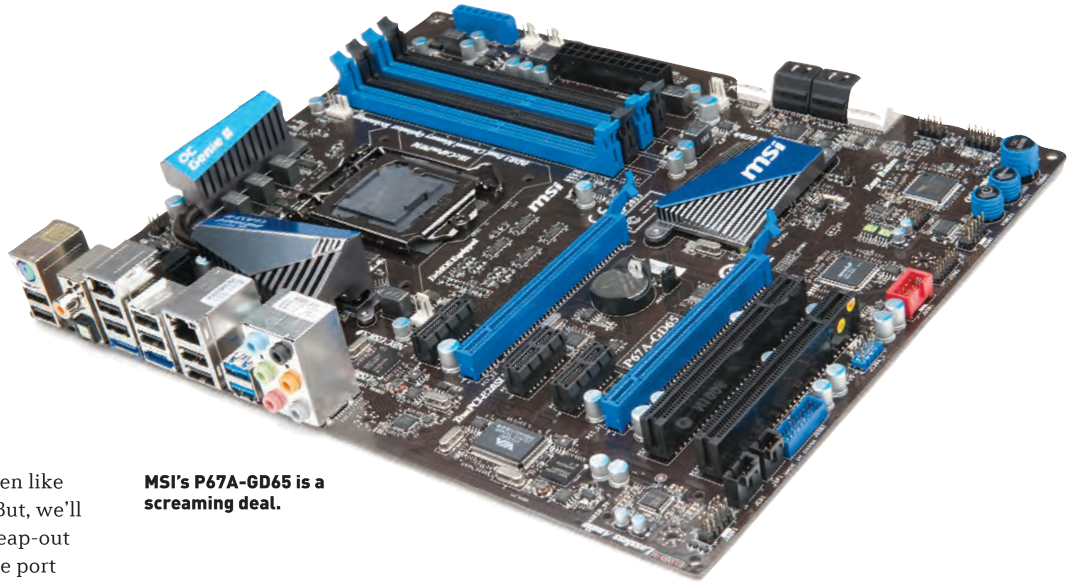
Also cool, but a bit tricky, is the inclusion of Asus's nifty Bluetooth control option for the board, which lets you boot, reset, shut down, and overclock the board remotely from popular smartphones. Asus said it tweaked the Bluetooth stack and app to make it easier to transfer files from your phone, too. While that aspect worked fine with our Android phone, we couldn't get the remote capability up and running. We've tested it successfully on other Asus boards, so we suspect that it's a side effect of the early application, or us.

In general performance, the Asus board held its own against the MSI, but both boards traded wins and losses. In other words, don't consider performance a deciding factor. We'd rather that you look at price, layout, and features. In those respects, it's hard not to recommend the P8P67 Deluxe as a worthy ride for your new Sandy Bridge chip.



ASUS P8P67
$240, www.asus.com

VERDICT **9**



MSI's P67A-GD65 is a screaming deal.

MSI P67A-GD65

We love Sandy Bridge, and we even like some aspects of the P67 chipset. But, we'll say it again: Intel's decision to cheap-out on SATA 6Gb/s will create massive port confusion. With the Asus board, we had to RTFM to figure out which port went to which controller and at what speed. The situation is murkier with the P67A-GD65. The board features eight SATA ports and tells you which are SATA 6Gb/s. Unfortunately, it doesn't tell you which controller they're running off of.

Windows 7 is so smart, though, that it will boot a board on the Marvell controller without missing a beat. However, if you're running a SATA 6Gb/s drive, you'll want to be on the Intel PCH, which is a good clip faster than the Marvell part. Unfortunately, the European manual that came with our early review board didn't tell us which controller ran which ports. The only way to figure it out was to plug in the drive, boot the board, and see which controller initialized in the BIOS.

But let's not get sidetracked. Despite this minor documentation issue (perhaps Europeans can sense what port to use), the P67A-GD65 is a solid board that's seriously cheaper than the Asus board on the facing page. And despite costing $60 less than the Asus P67 mobo, the P67A-GD65 is almost on par with its competitor. It has a secondary SATA 6Gb/s controller, an NEC USB 3.0 controller with two ports, and an additional two ports on a USB 3.0 dongle. What you don't get is the built-in Bluetooth features of the Asus board, nor its dual-Gigabit ports or front USB 3.0 bay, either. And while Asus gives you a choice of a Realtek network PHY or an Intel PHY, the P67A-GD65 gives you only the former. MSI does, however, give you access to Creative Lab's X-Fi algorithms. And in a tip of the hat to super-duper overclockers, the board also features a header to directly measure voltages off the board.

Like the Asus board, we tested whether this board could boot to a 3TB Western Digital drive, and both passed. Both also offered good USB 3.0 speed, ran SLI just fine, and offered comparable SATA 6Gb/s performance.

One feature that's slightly disappointing is the MSI ClickBIOS. MSI actually planned to release a board with UEFI more than a year ago, but that board never materialized. Still, we thought the early lead MSI had would have resulted in a highly polished UEFI interface. It's not terrible, but at times, the interface felt, well, like a BIOS, but with mouse navigation.

We tested both boards with some mild overclocking, pushing our 3.4GHz Core i7-2600K to 4.5GHz using the wimpy stock cooler. As expected, both passed just fine. Our only issue with the MSI board came with installing the drivers for the Creative audio. As with the Asus board, we'll chalk it up to early drivers or installers. For example, some of the drivers came on a USB key from the press office, so they're clearly not final.

Overall, the P67A-GD65 doesn't quite have the panache or super-smooth UEFI interface of the Asus, but it's also cheaper. In this economy, if that makes the difference to you owning a GeForce GTX 580, it's worth it.

BENCHMARKS

	Asus P8P67	MSI P67A-GD65
PCMark Vantage 64-bit	**11,250**	10,388
Everest Ultimate MEM Read (MB/s)	16,110	**16,492**
Everest Ultimate MEM Write (MB/s)	16,757	**18,602**
Everest Ultimate MEM Copy (MB/s)	**25,128**	21,628
Everest Ultimate MEM Latency (ns)	**35.8**	53.5
SiSoft Sandra RMA Bandwidth (GB/s)	15.7	15.8
3DMark Vantage Overall	14,845	**15,214**
3DMark Vantage GPU	11,947	**12,287**
3DMark Vantage CPU	**54,470**	53,282
Valve Particle test (fps)	**180**	177
Resident Evil low-res (fps)	132	131.7
HAWX low-res (fps)	244	**247**
HD Tune Pro Sustained Write w/ Marvell 6GB/s Controller (MB/s)	**208**	202.4
HD Tune Pro Burst (MB/s)	157	**167**
HD Tune Pro Sustained Write w/Intel 6GB/s Controller (MB/s)	**256.7**	242
HD Tune Pro Burst (MB/s)	170	**204**
HD Tune USB 3.0 (MB/s)	155.6	156
16GB POST test	Pass	Pass
3TB boot test	Pass	Pass
SLI test	Pass	Pass

We used a 3.4GHz Core i7-2600K, 4GB of Corsair DDR3/1600, 64-bit Windows 7 Professional, a Western Digital 150GB Raptor, and an EVGA GeForce GTX 285. To test SATA 6Gb/s, we used a Crucial C300 SATA 6Gb/s SSD on each controller. USB 3.0 performance was tested using an OCZ Enyo. To test SLI, we used two EVGA GeForce GTX 285 cards. Both boards were also booted with 16GB of Corsair DDR3/1333.

MSI P67A-GD65
$180, www.msicomputer.com
VERDICT **9**

ViewSonic 3DV5 3D HD Camcorder

3D video recording for cautious, cost-conscious consumers

The world has gone 3D loco. We've got 3D movies, 3D HDTV, and Blu-ray 3D. The NFL is working on 3D football broadcasts, and we think it's only a matter of time before Pepsico begins marketing Gatorade 3D.

Yep, consumers are jumping on the 3D bandwagon with cautious interest if not enthusiasm, which is why ViewSonic's new 3DV5 video recorder is intriguing: It costs just $180, which is a very low barrier to entry for 3D skeptics. The 3DV5 can record 3D, 720p video that can be played back on any 3D-capable TV or display. And it's got an autostereoscopic 3D screen ("Look, mom, no nerd glasses!") to boot.

The 3DV5 writes either JPEG or H.264 video files to the SDHC slot. The lenses are fixed focus and the only zoom is digital. Two 5-megapixel sensors inside the 3DV5 capture 30fps video for surprisingly effective 3D playback. You can view your 3D content right on the 2.4-inch LCD screen (more about that soon), but we think most enthusiasts will opt for playback on a 3D TV, computer display, or notebook (connectivity options include a full USB connector and HDMI). The 3DV5 also features onboard 3D conversion, so you'll be able to upload your movies to YouTube's 3D channel and watch your videos online with a set of old-school red/cyan 3D glasses.

On a large Samsung 3D HDTV equipped with shutter glasses, the image-quality limitations of the 3DV5 began to emerge. Sure, some of our test videos really did demonstrate the same kind of 3D spatial effects you see in Hollywood movies, but oftentimes the actual image quality, even at 720p, looked uncommonly low-res. The videos ran smoothly, however, and when we purposely filmed something to capture an obvious 3D effect (for example, someone slowly punching at the camera), the gimmick really worked.

The 3DV5's built-in autostereoscopic display is an interesting—but ultimately failed—attempt at 3D without the need for special eyewear. The display relies on parallax barrier 3D technology, and for the most part it falls short of delivering the 3D depth and separation that you'll see in a movie theater or on a living room HDTV. Spatial effects are prone to popping back and forth between 3D and 2D, and we found that the picture eventually began hurting our eyes (which, over time, developed into headaches).



The autostereoscopic LCD screen produces a 3D effect, though we experienced eyestrain and headaches after prolonged use.



The 3DV5 features two lenses that record simultaneously in order to create a moving 3D image.

Regardless of where we were viewing our content, we found that the 3D image "splits" when you shoot with the camera too close to a subject. This presents a conundrum, because one's inclination is to position the subject up close in the foreground—thus distinguishing it from the background for a richer 3D effect. We did, however, find that zooming the lenses toward our subjects—rather than positioning subjects extremely close-up from the get-go—could remedy the splitting problem. Just use this technique sparingly, because the 3DV5's digital zoom is crummy. Two or three stops up, and pixilation levels shoot to the moon.

Still, many of these gripes can be forgiven when you consider the price. For $180, you get a fully functioning HD camcorder that can shoot 2D stills, 2D video, 3D stills, and 3D video. ViewSonic has proven that budget 3D-video capture can work, and it did so first. That counts for something.

–ALAN FACKLER

VERDICT 8

VIEWSONIC 3DV5 CD HD CAMCORDER

+ SONIC BURGERS	– SONIC THE HEDGEHOG
Affordable, portable, and easy to use; 3D works reasonably well.	Low-res and grainy; bad digital zoom; disappointing onboard 3D LCD.

$180, www.viewsonic.com

Noctua NH-C14

A top-down approach to cooling

Noctua has wowed us before with its coolers: Both the NH-U12P (August 2009) and NH-D14 (April 2010) impressed us with top-tier performance. The NH-C14, which features a perpendicular cooling-fin stack and two fans, is larger than the former but smaller than the 2 pounds, 12 ounces of the latter.

The NH-C14's six heat pipes go into a stack of heating fins oriented perpendicularly to the motherboard, like a normal skyscraper stack turned 90 degrees; 14cm Noctua fans in their trademark peach-and-brown are clipped to each side of the stack, for a push-pull configuration that brings air straight down onto the motherboard. You can run the NH-C14 with both fans, just one, or none. The perpendicular configuration enables it to be used in cases with as little as 4.5 inches of clearance with only the bottom fan, or 5.5 inches for both fans. Like previous Noctua models, the cooler ships with low- and ultra-low-noise adapter cables, too.

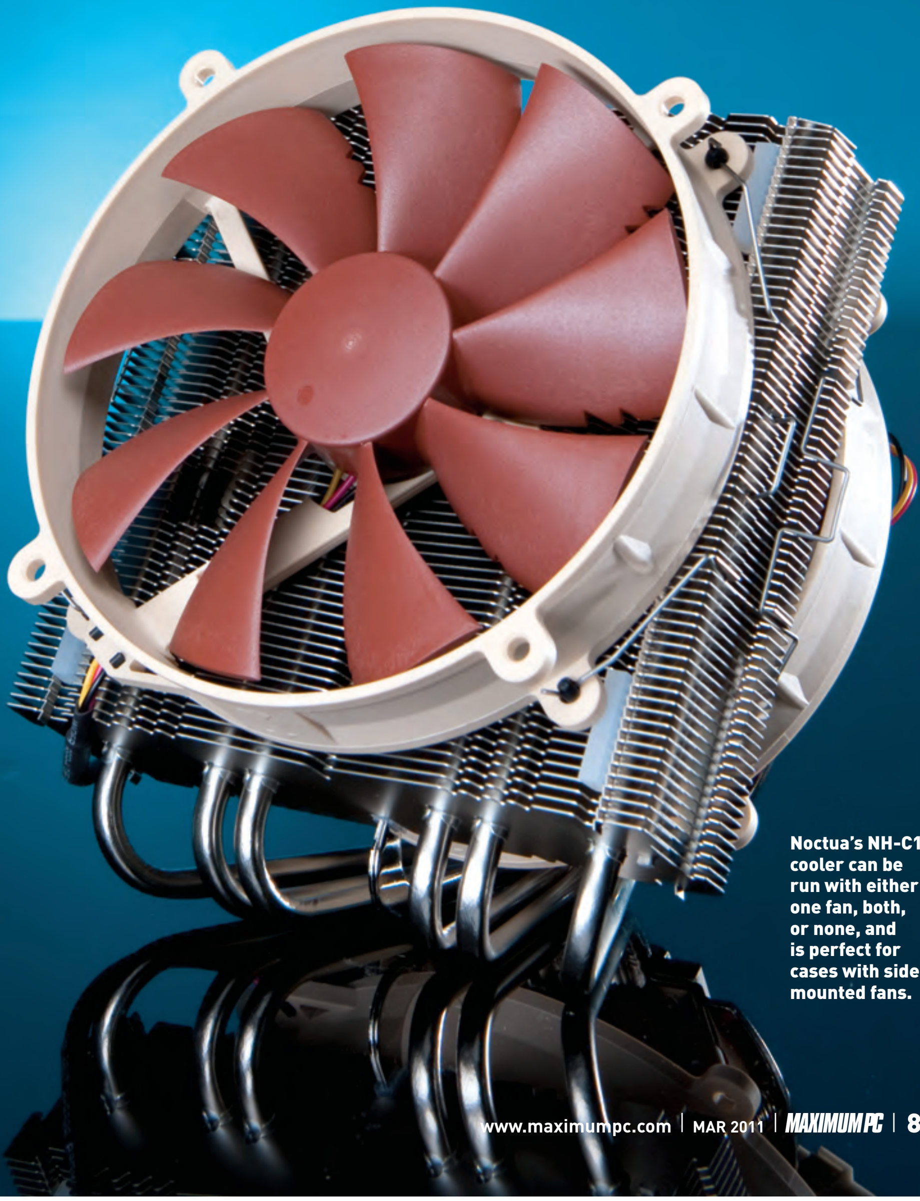
The NH-C14 uses the same Intel mounting bracket as the NH-D14 we reviewed in April 2010—a backplate, bolts, risers, and crossbars. Because the heat fins are directly above the mount point, the only way to install the cooler is to stick an (included) extra-long screwdriver into two holes cut into the heatsink directly above the screws, like a WWII prop fighter shooting bullets right between the propeller blades.

We pitted the NH-C14 against our standard two contenders: Prolimatech's Armageddon and Cooler Master's 212+, as well as against the NH-D14, which we hadn't retested on our new test bed. The NH-C14 outperformed the Cooler Master cooler, came within a few degrees Celsius of the NH-D14 (which handily outstrips the Cooler Master on our new, hotter test bed), but was around 5 C hotter at full burn than the Prolimatech Armageddon, which remains our cooler of choice. Repeating the test regimen in the NZXT Phantom (which has a side air intake directly above the CPU that we thought would help the NH-C14) produced virtually identical results. If you have a case with low motherboard clearance—like a high-performance HTPC—the NH-C14 is one of your best options. –NATHAN EDWARDS

BENCHMARKS

	Noctua NH-C14 (2 fans)	Noctua NH-D14 (2 fans)	Prolimatech Armageddon (2 fans)	Cooler Master Hyper 212+
Idle (C)	34.5	34	**32.75**	34.75
100% Burn (C)	63.25	62.5	**58.75**	65.5

Best scores are bolded. Idle temperatures were measured after an hour of inactivity; load temperatures were measured after an hour running Intel's internal Lynnfield thermal testing utility at 100 percent load. Test system consists of Intel Core i5-750 overclocked to 3.2GHz on an Asus P7P55D Premium board in a Corsair 800D case with stock fans. Temperatures taken with HWMonitor.



Noctua's NH-C14 cooler can be run with either one fan, both, or none, and is perfect for cases with side-mounted fans.

NOCTUA NH-C14 — VERDICT 8

+ NOCTE	– NOLTE
Great cooling with low vertical clearance; low-noise adapters.	Still bulky; pricey.

$90, www.noctua.at



The OnLive Gaming System is essentially a thin client for games. All the data processing takes place on servers in the cloud.

OnLive Game System

A decent console gaming system—with barely any console to speak of

Gamers fight a never-ending battle against hardware obsolescence. On the PC, each new generation of games demands faster and more capable CPUs and GPUs. Console gamers, meanwhile, have to buy a whole new system every few years. The OnLive Game System promises to change all that by moving most of the hardware processing into the cloud.

After logging onto the OnLive service, you can buy or rent a variety of games and start playing almost immediately. Unlike Valve's Steam service, you don't need to wait for the entire game to download, because OnLive's servers handle all the code crunching. That said, OnLive trails far behind Steam in terms of the number and quality of available games, with a library of just over 50 titles, many of which are dated. Yes, there are some big franchise names (e.g., Batman: Arkham Asylum, Assassin's Creed II), but there's nothing reeking of "just released Triple-A hit." OnLive told us the library would improve as more game publishers come on board.

You can play nearly every game for 30 minutes for free before committing to a purchase. Prices for a "Full PlayPass" (unlimited play) range from $10 to $50 per game. Many games can also be rented for three to five days for between $6 and $9. There's also a free spectator mode in which you can observe other players' games in progress.

Critics panned OnLive's PC and Mac streaming service when it launched earlier this year, criticizing it for shoddy image quality and choppy gameplay. The dedicated OnLive hardware box, however, gave us acceptable image quality at 720p. It was sharper than expected but there were compression artifacts. These minor visual defects were noticeable but hardly distracting. We also experienced minor gameplay disruptions in which the controller seemed to develop a mind of its own. These glitches happened rarely and persisted for just a second or two, but still impeded games that require split-second reflexes.

There really isn't much to the OnLive hardware. The tiny "console" (barely 3 inches wide) connects to your network via a 100Mb/s Ethernet cable, and to your display via HDMI or an analog component video connector. There are analog and TOSlink digital audio outputs, which are useful if your monitor is DVI- or component-only, or if your TV speakers just suck. You get a maximum video resolution of 1080p at 60Hz using HDMI, and 1080i at 60Hz using the component video adapter.

The device supports up to four wireless, rumble-enabled gamepads, but only one is included in the purchase price. The pads look similar to what you'd get with an Xbox 360. Unrepentant PC gamers can plug a mouse and keyboard into the console's two USB ports. As for your Internet connection, no budget DSL plans need apply: OnLive recommends a 5Mb/s downstream connection for displays larger than 40 inches.

We like OnLive. Its hardware and games are priced right, and the technology works as advertised. Would we consider this over a console for the big-screen experience? Perhaps. Will it replace your gaming rig? Hell no. A gaming PC with Steam is a far superior experience. Still, color us surprised, OnLive has some merit. –ALAN FACKLER

ONLIVE GAME SYSTEM VERDICT **8**

+ LIVE ROCK	– LIVE EMO
Sleek interface and form factor; great controller; impressive image quality.	Shallow, dated games library; minor compression artifacts and gameplay hiccups.

$100, www.onlive.com

OCZ RevoDrive X2 240GB PCI Express SSD

Return of the dizzying speeds

How can you improve on OCZ Technology's original RevoDrive (reviewed November 2010), which binds two SandForce SF-1200 SSDs to a PCI-E card? You add another two SSDs for a quad-drive SSD. That's what OCZ did for the RevoDrive X2.

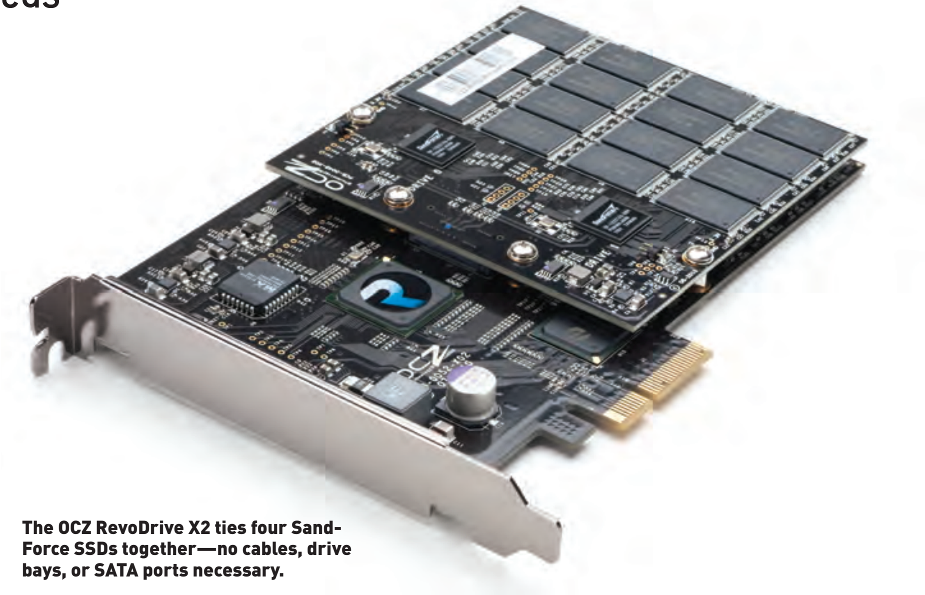
The original RevoDrive topped out at 500MB/s in very specific tests, and hovered around half that speed for most day-to-day usage, which still put it at the very top end of current-gen solid-state devices. OCZ claims the RevoDrive X2 can hit speeds up to 750MMB/s—that's *marketing megabytes* per second. Oh yeah, we're testing that.

Like its predecessor, the RevoDrive X2 contains a Pericom PCI-E-to-PCI-X bridge, a SiliconImage SiI3124 PCI/PCI-X-to-SATA controller, a bunch of SandForce SF-1200 controllers, and their attendant NAND. In fact, the only hardware difference between the RevoDrive X2 and the first RevoDrive we tested is the presence of a riser card, which adds another 120GB of NAND flash memory and two more SF-1200 controllers. That's essentially a RAID 0 of four 60GB solid-state drives. With the x4 PCI-E interface, that means this should be a blazing-fast drive.

Out-of-the-box HDTune sequential-read and -write performance topped 300MB/s, but dropped to an average of 244.8MB/s reads and 222.2MB/s writes thereafter—around the same as the first-version drive in read speeds, but a marked improvement over that drive's write speeds. Non-HDTune benchmark scores didn't slow down at all as the drive aged.

At queue depth 1, the Revo showed 4KB random-read and -write IOPS in the neighborhood of 12,000–13,000—a new record—but in our Iometer test, which writes 4KB files at random over the whole drive at a queue depth of 32, the score was off the charts, clocking in at over 117,000—44 percent faster than the first RevoDrive.

At larger file sizes, the RevoDrive X2 continued to impress—in ATTO (queue depth 4), which writes a variety of file sizes all over the disk, 64KB writes topped 661MB/s, and reads weren't far behind. This is half again the speed of the first RevoDrive, and three times the speed of a single Vertex 2 on a SATA connection. The RevoDrive X2 also cooked in real-world tests, blazing through our Premiere Pro encoding test in just 317 seconds—12 percent faster than the first RevoDrive. Its PCMark Vantage x64 HDD subscore, at 57,414, is the fastest we've seen by far.



The OCZ RevoDrive X2 ties four SandForce SSDs together—no cables, drive bays, or SATA ports necessary.

BENCHMARKS

	OCZ 240GB RevoDrive x2 (PCI-E x4)	OCZ 120GB RevoDrive (PCI-E x4)	OCZ 100GB Vertex 2 (3Gb/s)
Capacity	240GB	120GB	100GB
HDTune 4.01			
Avg Read (MB/s)	**244.8**	243.0	196.3
Random-Access Read (ms)	.1	**.0**	.1
Burst Read (MB/s)	211.9	175.2	**228.0**
Avg Write (MB/s)	**222.2**	175.3	221.9
Random-Access Write (ms)	.2	.2	**.1**
Burst Write (MB/s)	**208.3**	207.4	207.5
4KB Read (IOPS)	**12,039**	10,600	11,045
4KB Write (IOPS)	**13,254**	10,275	10,066
ATTO 64KB Read (MB/s)	**648.8**	449.7	269.1
ATTO 64KB Write (MB/s)	**661.3**	423.9	257.6
Iometer Random-Write IOPS (4KB, Queue Depth 32)	**117,014**	80,958	48,958
Premiere Pro (sec)	**317**	358	359
PCMark Vantage HDD	**57,414**	44,450	39,309

Best scores are bolded. All drives tested on our hard drive test bench: a stock-clocked Intel i7-930 CPU on an Asus P6X58D Premium motherboard with 6GB DDR3, running 64-bit Windows 7 Professional. All 3Gb/s tests performed using latest Intel ACHI drivers.

The Revo ain't perfect. You still have to install drivers manually via Device Manager, and load them with F6 if you're going to install Windows to the RevoDrive. Some motherboards require a BIOS update in order to boot from the Revo, or only allow installation in specific PCI-E slots; check http://bit.ly/gRCZzT for a list of those motherboards. Like its predecessor, the RevoDrive X2 lacks support for the Trim command but does include garbage-collecting algorithms that prevent it from getting too slow—indeed, after heavy use the drive was still humming along quite well.

With capacities that range from 100GB to 960GB, the RevoDrive X2 makes a disk-less PC seem almost feasible—if you don't mind dropping a bundle of money. The 960GB version is a cool $3,300, while the 240GB model we tested goes for $600. It's a tempting offer.

–NATHAN EDWARDS

VERDICT 9

OCZ REVODRIVE X2 240GB SSD

+ DOLBY	– DOBBY
Incredible speeds in high-load and real-world tests; no SATA cables required; bootable.	Finicky with some motherboards; pricey; no Trim support.

$600, www.ocztechnology.com

Thermaltake V9 BlacX Edition Chassis

Son of an unholy union between a chassis and a SATA dock

We'll admit it: When the Thermaltake V9 BlacX Edition mid-tower chassis showed up on our doorstep, we thought it was a joke. "Surely," we said, "Thermaltake didn't just slap one of its dual-bay BlacX hard drive docks onto a cheap mid-tower chassis and call it a day." Well, Thermaltake did, and in a really confusing way. The V9 BlacX Edition is virtually identical to the plain ol' V9, true, except the BlacX Edition has more features, better build quality, and a $60 dual-SATA dock slapped on the top. And it's $30 cheaper than the plain ol' V9. Er, what?

The V9 BlacX Edition is a black mid-tower chassis, painted inside and out. Its front bezel and top panel are made of chunky black plastic with metal honeycomb-mesh fan coverings and drive-bay covers. Both side panels have honeycomb-style cutouts at two of their corners, and the left side panel also has a clear plastic window placed diagonally from top left to bottom right. The case, which measures 8.5 inches wide by 19.3 inches high by 18.9 inches deep, is on the small side for a mid-tower, and can accommodate ATX and microATX motherboards. It has five toolless 3.5-inch drive bays, three 2.5-inch drive bays (sorry, screws required), and four 5.25-inch bays—though the top one is basically inaccessible, as it contains the SATA wiring from the underside of the BlacX dock. The case has three fans—a 12cm blue LED front intake fan, 12cm rear exhaust fan, and 23cm top exhaust fan—which keep the components inside cool.

The inside of the case is painted black, like the outside (a nice change from the V9). Six of the motherboard standoffs are extruded domes punched directly into the motherboard tray; the rest are the standard screw-in standoffs. The tray has a CPU backplate cutout, and some cable tie-downs near the front, but no cable-routing cutouts, which is a strange aesthetic choice in a case with a side window. The right-panel honeycomb mesh is also a weird choice, given that it's right in front of the hard drive bay and thus exposes the rats-nest of cables behind it.

The case has seven PCI-E expansion slots, which are secured by a weird plastic clamp system that makes expansion-card installation difficult and leaves them with a bit of wiggle room even when secured. Thankfully, the clamp system is removable and the expansion cards can be secured by screws if desired. The case can accommodate a CPU cooler up to 6.5 inches high, and a GPU up to 12.4 inches long—that's enough to fit a Radeon HD 5970.

The V9 BlacX Edition's front panel is at once both feature-packed and lacking. It's feature-packed in that it has USB 3.0, USB 2.0, audio, and (of course) two hot-swap SATA docks. Because the BlacX SATA docks are integrated directly into the chassis, they use straight SATA instead of USB or finicky eSATA, so they're much faster and more robust than an external dock. Whether because of the dock or for some other reason, though, the case has only one USB 3.0 and one USB 2.0 port at the front panel. That's not enough.

We still have no idea why Thermaltake decided to smash a $60 docking station into a $140 case, make concrete improvements to the case, and then charge just $110 for it. We also don't know why the company only put two front-panel USB ports on it, or gave us a side window but no behind-the-tray cable management. It's not the best-constructed or prettiest case you can get for $110—unless you really need the top hotswap SATA docks. **–NATHAN EDWARDS**

VERDICT 7

THERMALTAKE V9 BLACX EDITION

+ VIP	– V8
Integrated hot-swap SATA dock on top; decent airflow; accommodates long cards.	Only two front-panel USB ports; no behind-the-mobo cable routing; weird aesthetics.

$110, www.thermaltakeusa.com



Two hotswap SATA bays at the top of the case: good. Only two USB ports: bad.



Thermaltake did us the favor of tying down its USB 3.0 pass-through cable, unlike most case vendors.



This honeycomb mesh appears twice on each side panel, and not always in sensible places.



It's not the most inspired design, but from this angle the Thermaltake V9 BlacX Edition looks pretty good.



Hope you like WASD—the Marauder's arrow keys are merged into the number pad.



The Spectre: The least ergonomic mouse Razer has ever produced.

Razer StarCraft II Peripherals

Razer brings its B-game to Blizzard's legendary RTS

It's recently become popular for major PC game releases to be accompanied by their own line of branded peripherals, custom designed by big-name peripheral makers like Razer and SteelSeries. Frequently, these products are no more than a reskinning of a popular model, as is the case with the Call of Duty: Black Ops Stealth Mouse, which is essentially a rebranded Cyborg R.A.T. Other times, the tie-in is more substantial, as with the SteelSeries WoW mice, which feature unique, game-inspired designs as well as features and software intended to help you play the game better.

So, when we got the complete set of StarCraft II custom peripherals in for testing from Razer, we were curious to see whether they would be more like the former or the latter scenario. What we found out was surprising. —ALEX CASTLE

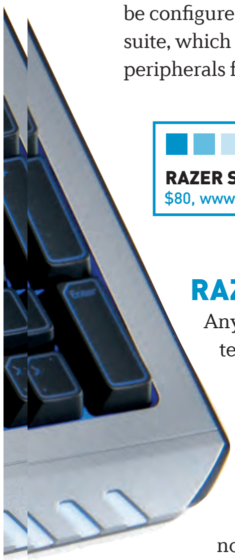
RAZER SPECTRE

The first product from the line that we tested, the Spectre, almost immediately raised some red flags. From a design standpoint, the Spectre is a big departure for Razer. It forgoes the company's trademark ergonomic, curved construction for a flatter and smaller-than-usual design. With hard, angled edges and a low profile, it's surprisingly uncomfortable for a product from a company with a lot of experience making mice that feel good to hold.

The Spectre (along with the rest of the set) is built of a silvery plastic that's meant to look like metal, but instead just comes across as sort of cheap. Razer is billing this mouse as "lightweight" but we'd rather just call it "flimsy." In short, the Spectre does not feel like an $80 gaming mouse.

Feature-wise, the Spectre is a mixed bag. It's got two side buttons, but only on one side—meaning that although this mouse is very nearly symmetrical, it's not functionally ambidextrous. It's equipped with a 5,600dpi laser sensor, and has a 1ms response time, which should be more than enough for any of your gaming needs, RTS or otherwise.

Two features unique to the Spectre are a hardware switch on the bottom that controls the force required to push the main mouse buttons, and a set of multicolor LEDs, which change shade based on your in-game actions per minute (or APM), a vital statistic for StarCraft players. The LEDs can



be configured in the well-executed software suite, which can control all three StarCraft II peripherals from a single control panel.

RAZER SPECTRE $80, www.razer.com	VERDICT	**5**

RAZER MARAUDER

Any decent StarCraft player can tell you the difference between a Diamond League pro and Bronze League scrub: It's all in the keyboard. Although StarCraft can be played entirely with the mouse, a good player is going to be hammering away at the keyboard nonstop throughout the match—issuing attack orders, queuing units and buildings, and jumping around the map.

Razer must understand this, because the Marauder is the high point of its SCII lineup. Not amazing, mind you, but solid enough.

From a design standpoint, the Marauder does a good job of matching the StarCraft II visual style, though it still features some of the ugly wannabe-steel plastic seen on the Spectre. The keys themselves are nicer, with a satiny rubber finish. They're your standard dome-switch keys, but with a little more resistance than usual, and a satisfyingly long travel.

In an interesting twist, Razer has gone for a shortened design with the Marauder—not by removing the number pad, as is most common, but by removing the arrow keys and the keys traditionally above them, such as Delete, Home, and Page Up. These keys have been mapped onto the number pad, and are accessed by hitting a new "Num Mode" key. We appreciate that the Marauder takes up less desk space than usual, but anyone who ever uses the keyboard for camera control or in any custom gametypes may find themselves at a disadvantage.

On the bright side, the Marauder is decked out with color-changing LEDs, with separate controls for the key lights, the Razer logo, and the underlights, which shine from underneath the keyboard. Like the whole lineup, these lights can be customized to change based on APM, or when certain events happen in-game—like when an enemy attacks your base, or when a unit is produced.

RAZER MARAUDER $120, www.razer.com	VERDICT	**7**



The Banshee's design would leave us scratching our heads, if all this plastic weren't in the way.

RAZER BANSHEE

Remember that ugly plastic we keep mentioning? With the Banshee, it seems Razer ended up with some sort of surplus of the stuff, and just decided to see how much it could possibly slap onto a single headset. The individual ear cups are simply enormous—bigger than any gaming headset we've used. That's OK though, as bigger cans theoretically means room for bigger drivers, and that's a good thing. We also know that with this set, Razer has opted to store the external soundcard hardware in the set itself, rather than in a dongle on the cord, as is more popular, which would account for some of the additional bulk.

What's hard to explain is the vast expanse of headband connecting the two earpieces, which is about 2.5 inches wide the whole way, and manages to be simultaneously bulky, heavy, and hideous.

All that plastic doesn't sit very well on the head. To make matters worse, the foam around the ear cups doesn't form a good seal, the ear cups themselves don't swivel much, which easily compromises the sound isolation. The boom microphone detaches to make the headset a bit more svelte, but the little rubber cap that covers the microphone port when the boom is detached isn't tethered to the headset in any way—all but guaranteeing that you'll lose it immediately.

The sound itself is pretty good, with good bass response and clarity comparable to other headsets in the Banshee's ~$100 price range. All the same, we expected better from such an enormous set, and the sound quality is marred by the set's poor fit.

RAZER BANSHEE $120, www.razer.com	VERDICT	**6**

So, in summary, the StarCraft II line of peripherals is a surprisingly low-quality offering from a well-regarded peripheral maker gifted with a major game license. There are a few bright spots—in particular the software controlling the three products is nicely done, and the color-changing LEDs make all three pieces look great in the dark, and provide an interesting channel for additional feedback from the game. However, the general low-quality feel of the parts, their unappealing visual design, and surprisingly high price points (the whole set will run you more than $300) makes Razer's StarCraft II line a hard sell.

World of Warcraft: Cataclysm Expansion

Blizzard puts the 'war' back in Warcraft

Six years of hard work. Hundreds of thousands of man hours. Twelve million subscribers who have spent billions of hours hacking, slashing, grinding, looting, and every other vaguely dirty term you can think of. So, how do you follow that? "Blow it all up," says Blizzard. "And use a dragon." The end result? A total reinvention of World of Warcraft that'll have you hooked from the first second and keep you there for—oh—a couple hundred more hours. At least.

Don't get us wrong; at the end of the day, Cataclysm still follows the basic MMO formula of killing and collecting. However, the extent to which Blizzard has rebuilt the process is nearly mind-blowing. In Cataclysm, quests are focused and generally tied into an overarching narrative. Unless you're piloting a bomber plane, you won't see any more "kill 60 of *x* monster" quests. Instead, you might be tasked with killing 10 of something, looting them, and interacting with the environment nearby—all at once. Presto: That's three quests finished in roughly 10 minutes. No muss, no fuss, and, unlike the majority of MMOs, it actually makes sense. Also, it's completely epic.

We don't use that word lightly, but nowhere is it better exemplified than in the starting areas of the two new races: Goblins and Worgen. Both are brilliantly paced storylines with giant 100-man battles, appearances by legendary WoW lore characters, and a couple of cameos from the life of Cataclysm's party, Deathwing himself. Beyond that, however, the two races couldn't be more different. Worgen watch their society crumble as it's slowly consumed by a mangy, howling curse while Goblins go on a hilarious, pop-culture-referencing romp that includes wild parties, fast cars, and being turned into a tornado that shoots lightning bolts. In both cases, it's almost like playing a single-player RPG—and a damn good one at that. To play Cataclysm, you'll need both previous expansion packs—Wrath of the Lich King and The Burning Crusade—but who plays WoW without those?



Giant encounters like this are a regular occurrence during Worgen quests.



And giant, er, parties are a semi-regular occurrence during Goblin quests.

The new high-level questing content is similarly excellent, if not better. The five new zones are pretty much uniformly fantastic, with only Mount Hyjal descending to a level even resembling mediocrity—but that's more a case of failed ambition than lack of effort. The seven new high-level instances, meanwhile, are some of the best WoW's ever seen. Fast and focused yet inventive and tactical, these dungeons will eat you alive the second your brain goes on autopilot. Bickering pick-up groups need not apply.

PvP, unfortunately, is a mixed bag. On one hand, you have the two new arenas—Battle for Gilneas and Twin Peaks—which are great. The new PvP zone Tol Barad, however, favors the defending side to the point where attacking is often an exercise in futility and frustration. On paper, the zone's got a lot going for it, but it needs some serious work. Speaking of "serious work," we're not even sure that'll save the new profession, archaeology. Much as we wanted to love it, it's mostly boring, time-consuming, and requires far too many steps. Sure, the rewards are occasionally amazing, but by and large you're basically digging for gold in a landfill.

In the grand scheme of things, though, those flaws are extremely minor. Hell, there's a good chance you'll never even encounter them. What you will find, however, is—to butcher a classic Disney song—a whole new World of Warcraft. And whether you're a vet haunted by flashbacks to your days in Molten Core or an outsider wondering what all the fuss is about, there's no better time than now to dive in.

—NATHAN GRAYSON

MAXIMUMPC KICK ASS!

WOW: CATACLYSM EXPANSION VERDICT **9**

+ WARGAMES	– INSPECTOR GADGET
Streamlined, story-centric questing; excellent new races and starting zones.	Mount Hyjal; an unbalanced new PvP zone; a new profession that's mostly a waste of time.

$40, www.worldofwarcraft.com, ESRB: T

LAB NOTES

Move over, LightScribe

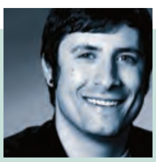
Lite-On's LabelTag works with any disc



This month, I spent some time testing Lite-On's 24x iHAS524. I wasn't so curious about the drive's read and write performance—it's essentially the same as the Lite-On 24x iHAS424 that I reviewed in the January 2010 issue. Rather, I was curious about the newer model's inclusion of LabelTag—Lite-On's answer to the LightScribe disc-labeling technology. LabelTag addresses some of LightScribe's inconveniences. For one thing, LabelTag can work with any kind of disc, unlike LightScribe, which only supports specially coated discs. Also, because LabelTag creates a label on the data side of the disc, it functions as a seamless part of the disc-burning process—no taking the disc out and flipping it over for label creation. The downside, however, is that LabelTag eats up space on the disc. Our label here, for instance, took more than 2GB of our 4.5GB disc. Lite-On bundles LabelTag with the Nero Essentials software that ships with the iHAS524 ($40, www.liteonit.com).



KATHERINE STEVENSON
DEPUTY EDITOR



NATHAN EDWARDS
SENIOR ASSOCIATE EDITOR

I saw a lot of awesome upcoming tech at CES this year—the chassis alone are really exciting, and there's tons of news in CPU coolers and SSDs, too. I think I counted four new liquid-cooling loops alone. Plus: awesome new cases from NZXT, Fractal, Corsair, and Cooler Master.



MICHAEL BROWN
REVIEWS EDITOR

I've been writing about videocards off and on ever since the days of 3Dfx Voodoo Graphics. Now that I'm transitioning to our sister publication *Maximum Tech*, I'm handing that beat to Senior Associate Editor Nathan Edwards. I'll continue to cover beats relevant to both magazines, including speakers, wireless networking, home servers, media streaming, and others.



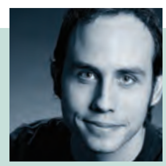
GORDON MAH UNG
SENIOR EDITOR

I've been saying for some time that ARM could be the most significant risk to the PC, and this year's CES confirms it. The lowly x86 has defeated MIPS, SPARC, PowerPC, et al. It has banished thin-clients and conquered supercomputers, but ARM is the biggest threat today. That's because ARM chips reproduce like insects while PCs reproduce like humans.



ALAN FACKLER
ASSOCIATE EDITOR

I'm stoked about MaximumPC.com. By the time you read this, we'll probably have our new and revamped look, and we're also ordering some Canon Vixias for future videos—these little badasses can record the highest AVCHD bit rate possible, and will allow us to get audio in-camera using a hot-shoed mic (finally). Only the best for you, dear readers.

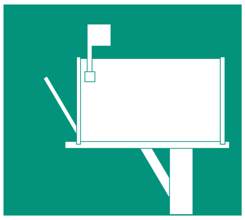


ALEX CASTLE
ONLINE MANAGING EDITOR

This last month, I've been playing around with the Unity 3D game engine, which is available for free at Unity3D.com. It still takes a little bit of programming know-how, but I'm astonished at how easy the engine makes it to develop great-looking, professional-quality games. It's an easy recommend to anyone who wants to learn to make games.

We tackle tough reader questions on...

‣Windows Home Server
‣Vapor Cooling
‣Broadband for All?



WTF with WHS?

Your January issue walks readers through building a robust home server. Wouldn't you agree it's a bit irresponsible to advise readers to build their servers using a beta release of Windows Home Server (Vail)? The license is due to expire soon, and it appears highly unlikely that data stored on the beta release of this server can be migrated to a release candidate or final release version. Another thing: It appears that the Drive Extender feature that makes v1 of Windows Home Server so cool will be scrapped on the final release of Vail. While enthusiasts are petitioning MS to reverse the decision to scrap Drive Extender, MS hasn't responded.

Finally, in the Comments pages at the back of the January issue, a reader correctly states that there is no theoretical limit to the number of drives in a pool on Windows Home Server. Michael Brown responded that MS won't support more than five drives in v1 and 10 drives in Vail. Where does this information come from? MS has acknowledged that there is no theoretical limit on the number of drives in a WHS pool, which implies that there is no reason whatsoever that more than five drives wouldn't be supported.

—Terrance Thompson

Reviews Editor Michael Brown Responds: *Maximum PC* has targeted savvy readers from day one, so we never waste precious word count explaining things we assume the reader will take for granted. In this story, we assumed that readers would know better than to depend on beta software as a reliable or permanent solution. In retrospect, a reminder might have been in order.

Regarding Microsoft's unfortunate decision to strip Drive Extender from Vail's feature set, that announcement was made after we sent the January issue to the printer (yes, print deadlines suck and the removal of Drive Extender support has significantly cooled our enthusiasm for Vail). As for the limited number of drives that Windows Home Server officially supports, the information was provided by Michael Leworthy, a senior product manager from Microsoft's Windows Small Business Server team. If you can provide the name of the Microsoft employee who has said otherwise, it would be interesting to find out who is correct.

WHS and RAID

Building the small form factor next-gen server was a nice read (Build It, January 2011). Considering my limited knowledge, I have a few questions. First, does the Zotac motherboard have a built-in RAID controller?

CUTCOPYPASTE

‣In our February Build-It ("Build a Silent Gaming PC"), we neglected to include the motherboard in the parts list. We used an Asus P6X58D Premium board, which retails for $285.

‣In January's "Luxury Towers" roundup, we said that the NZXT Phantom chassis doesn't support EATX motherboards; it does.

NOW ONLINE

The 30 Must-Play Games of the Decade

You know that stereotype of the total loser from high school—busted glasses, craggy acne-canyon of a face, every spoken word followed by a refreshing mist of saliva—who goes on to become rich and successful beyond your wildest dreams? Well, that's the gaming industry's past 10 years in a nutshell. No longer is gaming that shameful hobby you mumble about in between "hanging out" and "...uh, other stuff." Now, it's just something everyone does—gaming has finally arrived.

That's why we thought it'd be fitting to spotlight some of the games that helped put our favorite pastime on top of the world. Hit up http://bit.ly/fdzujH for our list of the 30 best PC games of the past decade!



Second, what would be a good RAID controller card that doesn't bust the wallet and yet provides a robust RAID 1 or 5 in the next-gen server? I am assuming that if a RAID controller is indeed used, it probably will take the lone PCI-E slot on the mobo.

—Vaibhav V. Haldavnekar

Contributing Editor Loyd Case Responds: The Zotac H55 motherboard does not have a built-in RAID controller. Since Windows Home Server doesn't officially support RAID, I didn't feel the lack of RAID was particularly significant. I've used Promise PCI-E RAID controllers with reasonably good results. Again, those aren't suitable for Windows Home Server, but if you're building a Linux box, they work fairly well and aren't too expensive.

Vertical Vapor-Chamber Cooling?

I have been looking at the new vapor-chamber graphics cards that have been coming out recently, and I'm curious about one thing: How will the cooling design work with the GPU mounted vertically? I recently bought the Silverstone Raven RV02-E chassis, which mounts the mobo at 90 degrees. With the GPUs mounted vertically, will I experience higher temperatures?

—Erik Korsgard

Senior Associate Editor Nathan Edwards Responds: Vapor chambers work in the same way as a big heatpipe—they rely on pressure and wicking, rather than gravity, to move coolant around. Vapor-chamber GPUs will work just as well in a vertical configuration. In fact, Maingear, whose Shift gaming PC is built on a Silverstone chassis, touts the vertical alignment as working very well for vapor-chamber GPUs.

WinPhone Wonder

I just synced my personal OneNote notebook between my PC, SkyDrive, and my new Windows 7 phone and it's flawless! I make a note, pin it to my home screen and no longer have to use my Calendar to remind me of those little things I'm tracking. Oh, and I can add lists, pictures from the camera roll, take new pictures, and add voice notes from my phone. This will change both the way I do business *and* the way I keep my personal life organized. Training myself to use OneNote instead of my calendar, email reminders, yellow stickies, and scratch paper will be a challenge but since all three are synced automatically, my life isn't over if I lose my phone or my PC crashes. I am no longer a begrudged Microsoft user.

—Jason Brock

Editor-in-Chief George Jones Responds: You're right on this one, Jason. After testing several different phones and mobile operating systems over the last half-year, I've settled into the Samsung Focus Windows Phone as my real-life smartphone. It's been interesting to see and hear people's reactions to this first generation of WinPhones. Sight unseen, people initially hate on them because of Microsoft phobia. But once they see the phone in action, they're almost always surprised and impressed. As far as first releases go, this is an excellent start. Oh, and for what it's worth, I've just discovered the OneNote functionality, as well—its versatility is surprising.

Town vs. Country

In your story about Level 3 and Comcast (Quick Start, February 2011), Paul Lilly said the future of content consumption lies in streaming media. I disagree, because half the country can't even get high-speed broadband! If you aren't a city-dweller you are out of luck as far as Internet service is concerned, and even a lot of people who live in the city can't get high-speed service that's fast enough for streaming video. I live in the city limits, and the fastest rates available are Wi-Fi from McDonald's with a download speed of 1Mb. That will work to download a video if I want to wait for a couple of days, but won't play anything live unless it's streaming pretty slow. If all those streaming companies want people to use the service, they are going to have to come up with a way for people to get high-speed broadband that's fast enough to actually do the streaming.

—Steve C.

LETTERS POLICY Please send your questions and comments to comments@maximumpc.com. Include your full name, city of residence, and phone number with your correspondence. Letters may be edited for space and clarity. Due to the amount of mail we receive, we are unable to respond personally to all queries.

NEXT MONTH

COMING IN MAXIMUM PC'S YEAR OF THE RABBIT APR ISSUE

The Cheapskate's Guide to Power Computing

Just in time for tax season: A compendium of money-saving PC tips, projects, and tricks. Ditch your cable bill, boost PC performance for pennies, and more.

Keyboard Torture Test

Initially, we thought Online Managing Editor Alex Castle was using all those keyboards to build a private fortress. When we found out that he's been prepping for a high-performance keyboard round-up, we breathed a sigh of relief.

Annual Gaming Awards

What were the best games of 2010? How many great games—both big and small—did you miss? Don your tuxedo; the awards ceremony is about to start.

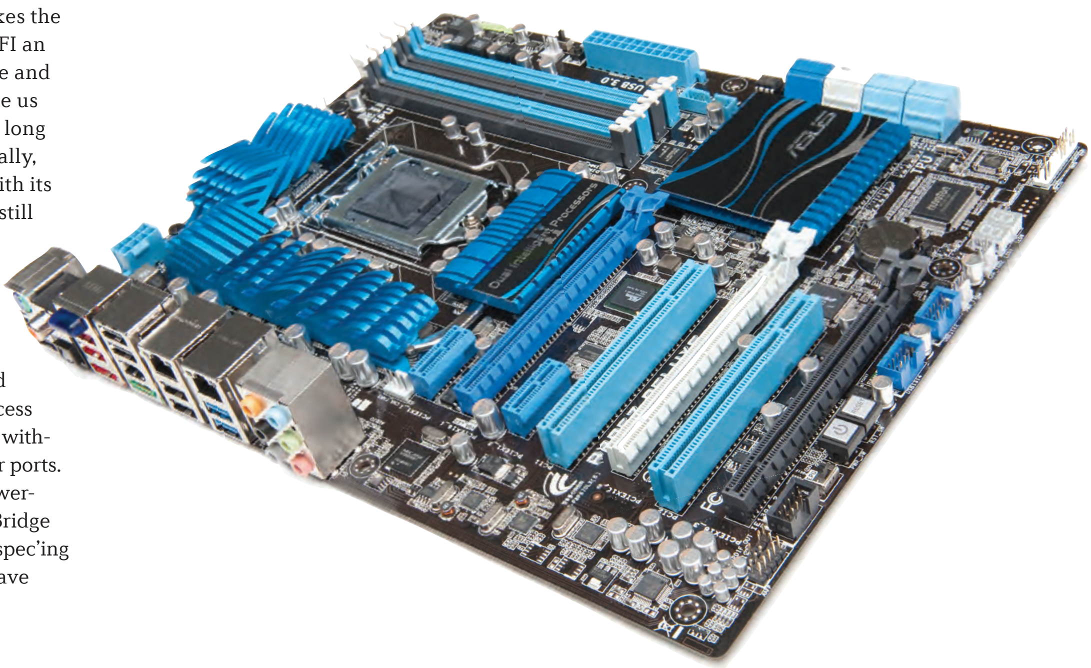
HIGH-END MOBO

EVGA Asus P8P67 Deluxe

The Asus P8P67 Deluxe makes the transition from BIOS to UEFI an easy one. Its beautiful interface and drag-and-drop boot order make us wonder why the hell it took so long for UEFI to arrive. Yes, technically, Intel beat Asus to the punch with its UEFI boards, but those boards still use a BIOS-like interface.

It's not just the UEFI, though—the Deluxe also gives you integrated Bluetooth, SATA 6Gb/s, and USB 3.0 ports galore. Even better, the board's included USB 3.0 bay adapter lets you access those SuperSpeed ports in front without having to use all of your rear ports. With the astoundingly great power-to-performance ratio of Sandy Bridge processors, it's hard not to start spec'ing out a new machine when you have such an impressive foundation.

www.asus.com



THE REST OF THE BEST

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Intel 3.33GHz Core i7-980X
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Midrange Processor
Intel 3.4GHz Core i7-2600K
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Asus Rampage III Extreme
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Performance GPU
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XFX Radeon HD 6850
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Capacity Hard Drive
Western Digital Caviar Black 2TB
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Performance Storage
OCZ Vertex 2 100GB SSD
www.ocz.com

Air Cooling
Cooler Master Hyper 212+
www.coolermaster.com

High-End Cooler
Prolimatech Armageddon
www.prolimatech.com

Full-Tower Case
Corsair 800D
www.corsair.com

Wi-Fi Router
Netgear WNDR3700 V1
www.netgear.com

Gaming Mouse
Madcatz Cyborg R.A.T.7
www.cyborggaming.com

Games we are playing

Fallout: New Vegas
www.fallout.bethsoft.com

Civilization V
www.civilization5.com

World of Warcraft: Cataclysm
www.worldofwarcraft.com

Minecraft
www.minecraft.net

For even more Best of the Best entries, such as speakers and budget components, go to http://www.maximumpc.com/best-of-the-best.

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